SiMKit

Release Notes for SiMKit public version 6.2

Eindhoven, July 2025

NXP Semiconductors
DE/AMS-RF Simulation
E-mail: ams-rf.sim.helpdesk@nxp.com

Preface

These are the release notes for simkit version 6.2. Changes with respect to simkit 6.1 are reported in these release notes.

The main developments of this release are:
- PSP104 was updated to version 104.0.1.
- JUNCAP200 was updated to version 200.6.3.
- ASM-ESD was updated to version 101.1.0
- The $simparam mechanism was enabled for ADS.
- the MINT 3 version, used on old ADS versions, is not supported anymore.
- Added device info in the SOACHECK_DEBUG message.
- Added DC match in Spectre adapter for PSP104.
- The Pstar-specific connection was removed from this SiMKit version. The Pstar adapter and the Pstar specific model libraries (PMK) were removed.
- SiMKit library was built on RHEL8, SiMKit on RHEL7 is not supported anymore.

Overview

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(/APS): the Cadence circuit simulator.
- ADS: the Keysight circuit simulator.
  Simkit 6.2 supports ADS 2017 and higher. The SiMKit distribution is also available for ADS on Windows for ADS 2019.1 and higher.

Mica from NXP, AFS from Siemens, 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

New models

- none

Model improvements and bug-fixes

PSP104 (104.0.1)

This release includes the bug fixes in the original verilog-A code:
- addition of new variables aphi, V_xb
- addition of new variables dVbstar to fix the bug on NUD effect model
- modification of delxb calculation to fix bug on nscr and ysat NAN issue
- addition of qbscr and qiscr initializing
- new condition for SCE model for negative gate voltage
- new calculation of qbscr to fix bug on qbscr NAN issue
- xn_s is now calculated in the condition
- addition of a new condition on x_inf calculation to avoid division by zero
- new calculation of qisat and qbsat to fix NAN issue
- new calculation of delta_gmob to fix possible negative gds
- the calculations of device temperature variables (TKA, rTa, delTa, etc.) are moved because their values depend on instance parameter TRISE
- removing the if statement on SWIGATE=2 (bug fix correction)
- addition of a new variable V_xb_dc_tmp
- addition of a new variable dVbstar_dc to fix the inappropriate behavior of NUD effect model; dVbstar_dc is set to zero in case the NUD effect is disabled
- temp variable is replaced by V_xb variable

PSP104.0.1 is backward compatible with PSP104.0.0 (in SiMKit 6.1)

JUNCAP200 (200.6.3)

This release includes the bug fixes in the original verilog-A code:
- The code organisation is changed to separate the calculation of instance independent variables to instance dependent variables due to the introduction of the TRISE parameter

JUNCAP200.6.3 is backward compatible with JUNCAP200.6.2 (in SiMKit 6.1)

ASM-ESD 101.1.0

This release contains the updated version 101.1.0 for the 4 device models of the ASM-ESD family:
- asmesd_3t (ASM-ESD without selfheating)
- asmesd_4t (ASM-ESD with selfheating)
- asmesd_dio_2t (ASM_ESD diode without selheating)
- asmesd_dio_3t (ASM-ESD diode with selfheating)

SiMKit version 6.1 contained a beta version of this ASM-ESD version, this SiMKit 6.2 release is based on the final 101.1.0 version approved by the CMC.
The changes are the following with respect to 101.0.0:
- 4 devices are now made available, instead of a single asmesd device.
- the Qde charge formulation was updated for base resistance charge dependence.
- the tff transit time formulation was updated for better model fitting of overshoot data.
- the minr parameter is better handled, following CMC recommendations.
- the texp parameter has now a default value of 2.0 and should be positive.
- the ikr parameter has now a maximum value of 1000.0.

Finally, these 4 devices were also fully tested with the newly available CMC QA testset.

SOA checks

- Added device info in the SOACHECK_DEBUG messages.

Spectre specific
==
- Added DC match in Spectre adapter for PSP104.

ADS specific
==
- The $simparam mechanism, enabled in the SiMKit interface in SiMKit 6.1, was enabled in the ADS adapter. It is currently only used to pass the minr option to the ASM-ESD model.
- The MINT 3 version, used on old ADS versions, is not supported anymore.

- Due to limitations in the development environment, the libraries for Windows
  could not be provided. Users are advised to run with an earlier SiMKit version.

Known limitations

Overvoltage checking:
- Overvoltage checks do not give warnings in ADS as in Spectre.

SOA check support in PrimeSim:
- At the time of this release, the required interface to enable SOA checking
  in SiMKit was not enabled yet in PrimeSim U-2023.03-SP2-2 and before. Hence
  SOA checking using SiMKit monitors will not work with PrimeSim.

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 (from
  simkit 4.9 those are PSP, PSPNQS, MXT504, 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.

Aliasing of reference temperature for JFETIDG with ADS:
- Recognition of reference temperature names TNOM and its alias TREF is not
  working with ADS for ADS versions lower than 2022.

Transient noise:
- Transient noise is supported in general, but in cases where correlated
  noise (e.g. induced gate noise) is dominant, the results will be unreliable.
  This is because the separation between bias dependent and frequency dependent
  noise contributions is not strict, which is a requirement for the simulator
  interfaces.
  A workaround is to switch off induced gate noise, which can be done in
  mos1101 and mos1102 by setting GATENOISE=1. Refer to artf79836 for details.
  From simkit 4.6 onward, a switch option SWIGN=2 was added to psp102 and from
  simkit 5.5 onward, this switch is also implemented in psp103:
  . For SWIGN==0 the induced gate noise is switched off.
  . 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 because the noise is implemented using white noise sources only
    (like in the Verilog-A version of PSP). Because extra internal nodes are
    needed, simulations will slow down.
  In practice, induced gate noise has a very minor effect and switching it off
  will hardly influence simulation results.

SiMKit models

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/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
psp	104	psp104	psp104	eg	no	no
psp	104	psp104t	psp104t	eg	yes	no
pspnqs	104	pspnqs104	pspnqs104	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
rfldmos	602	rfldmos602t	rfldmos602t	g	yes	yes**
rfldmos	602	rfldmos602dt	rfldmos602dt	g	yes	yes**
psphv	1	psphv	psphv	g	no	no
psphvt	1	psphvt	psphvt	g	yes	no
jfetidg	1	jfetidg	jfetidg	g	no	no
jfetidgt	1	jfetidgt	jfetidgt	g	yes	no
lutsoi102	102	lutsoi102	lutsoi102	g	no	no
lutsoi102t	102	lutsoi102t	lutsoi102t	g	yes	no
asmesd_3t	101	asmesd_3t	asmesd_3t	g	yes	no
asmesd_4t	101	asmesd_4t	asmesd_4t	g	yes	no
asmesd_dio_2t	101	asmesd_dio_2t	asmesd_dio_2t	g	yes	no
asmesd_dio_3t	101	asmesd_dio_3t	asmesd_dio_3t	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 rfldmos 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
diode	500
mos	902
mextram	503
lpnp	301
mos	705

From simkit 4.8 onwards, the mextram 3500 model is no longer supported. From simkit 4.0 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.

Table 3: Model version numbers

The models in simkit 6.2 are based on the following Verilog-A versions:

model	version
JUNCAP200	200.6.3
PSP102	102.5.0
PSP103	103.8.2
PSP104	104.0.1
Mextram504	504.13.1
Mextram505	505.4.0
RFLDMOS602	602.01.00
PSPHV	1.0.6
JFETIDG	1.0.4
LUTSOI102	102.6
ASMESD_3T	101.1.0
ASMESD_4T	101.1.0
ASMESD_DIO_2T	101.1.0
ASMESD_DIO_3T	101.1.0

SiMKit interface

Simkit 6.2, 6.1 incorporate interface version 16, which is backward compatible with version 15 used in simkit 5.9–6.0, with version 14 used in simkit 5.8, with version 13 used in simkit 5.7, with version 12 used in simkit 5.5–5.6, with version 11 used in simkit 5.1–5.4, with version 10 used in simkit 4.7–5.0, with version 9 used in 4.4–4.6 and with version 8 used in simkit 4.0–4.3 but not backward compatible with the interface versions used in simkit 3.8 and earlier.

The interface description document simkitInterfaceDescription.pdf is contained in the zipped model library.