

12 PSP syntax

12.1 Simulator specific items

12.1.1 PSP model

Pstar syntax

n channel local (electrical) model:

pspe_n(d,g,s,b) level=102, type=1, <parameters>

p channel local (electrical) model:

pspe_n(d,g,s,b) level=102, type=-1, <parameters>

n channel global (geometrical) model:

psp_n(d,g,s,b) level=1020, type=1, <parameters>

p channel global (geometrical) model:

psp_n(d,g,s,b) level=1020, type=-1, <parameters>

n channel global (binning) model:

psp_n(d,g,s,b) level=1021, type=1, <parameters>

p channel global (binning) model:

psp_n(d,g,s,b) level=1021, type=-1, <parameters>

n : occurrence indicator.

<parameters> : list of model parameters.

d,g,s and b are drain, gate, source and bulk terminals respectively.



Care

When assignment by position is used, the order of the parameters must be equal to the order specified in the model definition. Readability is improved if assignment by name is used.

Spectre syntax

n channel local (electrical) model:

```
model modelname psp102e type=n <modpar>
componentname d g s b modelname<inpar>
```

p channel local (electrical) model:

```
model modelname psp102e type=p <modpar>
componentname d g s b modelname<inpar>
```

n channel global (geometrical) model:

```
model modelname psp1020 type=n <modpar>
componentname d g s b modelname<inpar>
```

p channel global (geometrical) model:

```
model modelname psp1020 type=p <modpar>
componentname d g s b modelname<inpar>
```

n channel global (binning) model:

```
model modelname psp1021 type=n <modpar>
componentname d g s b modelname<inpar>
```

p channel global (binning) model:

```
model modelname psp1021 type=p <modpar>
componentname d g s b modelname<inpar>
```

modelname : name of model, user-defined.

componentname : occurrence indicator.

<modpar> : list of model parameters.

<inpar> : list of instance parameters.

d,g,s and b are drain, gate, source and bulk terminals respectively.

**Note**

Warning! In Spectre, use only the parameter statements type=n or type=p. Using any other string and/or numbers will result in unpredictable and possibly erroneous results.

ADS syntax

n channel local (electrical) model:

```
model modelname psp102e gender=1 <modpar>
componentname d g s b modelname<inpar>
```

p channel local (electrical) model:

```
model modelname psp102e gender=0 <modpar>
componentname d g s b modelname<inpar>
```

n channel global (geometrical) model:

```
model modelname psp1020 gender=1 <modpar>
componentname d g s b modelname<inpar>
```

p channel global (geometrical) model:

```
model modelname psp1020 gender=0 <modpar>
componentname d g s b modelname<inpar>
```

n channel global (binning) model:

```
model modelname psp1021 gender=1 <modpar>
componentname d g s b modelname<inpar>
```

p channel global (binning) model:

```
model modelname psp1021 gender=0 <modpar>
componentname d g s b modelname<inpar>
```

modelname	:	name of model, user-defined.
componentname	:	occurrence indicator.
<modpar>	:	list of model parameters.
<inpar>	:	list of instance parameters.

d,g,s and b are drain, gate, source and bulk terminals respectively.

12.1.2 PSPNQS model

Pstar syntax

n channel local (electrical) model:

pspnqse_n(d,g,s,b) level=102, type=1, <parameters>

p channel local (electrical) model:

pspnqse_n(d,g,s,b) level=102, type=-1, <parameters>

n channel global (geometrical) model:

pspnqs_n(d,g,s,b) level=1020, type=1, <parameters>

p channel global (geometrical) model:

pspnqs_n(d,g,s,b) level=1020, type=-1, <parameters>

n channel global (binning) model:

pspnqs_n(d,g,s,b) level=1021, type=1, <parameters>

p channel global (binning) model:

pspnqs_n(d,g,s,b) level=1021, type=-1, <parameters>

n : occurrence indicator.

<parameters> : list of model parameters.

d,g,s and b are drain, gate, source and bulk terminals respectively.



Care

When assignment by position is used, the order of the parameters must be equal to the order specified in the model definition. Readability is improved if assignment by name is used.

Spectre syntax

n channel local (electrical) model:

```
model modelname pspnqs102e type=n <modpar>
componentname d g s b modelname<inpar>
```

p channel local (electrical) model:

```
model modelname pspnqs102e type=p <modpar>
componentname d g s b modelname<inpar>
```

n channel global (geometrical) model:

```
model modelname pspnqs1020 type=n <modpar>
componentname d g s b modelname<inpar>
```

p channel global (geometrical) model:

```
model modelname pspnqs1020 type=p <modpar>
componentname d g s b modelname<inpar>
```

n channel global (binning) model:

```
model modelname pspnqs1021 type=n <modpar>
componentname d g s b modelname<inpar>
```

p channel global (binning) model:

```
.model modelname pspnqs1021 type=p <modpar>
componentname d g s b modelname<inpar>
```

modelname	:	name of model, user-defined.
componentname	:	occurrence indicator.
<modpar>	:	list of model parameters.
<inpar>	:	list of instance parameters.

d,g,s and b are drain, gate, source and bulk terminals respectively.

✓ **Note**

Warning! In Spectre, use only the parameter statements `type=n` or `type=p`. Using any other string and/or numbers will result in unpredictable and possibly erroneous results.

ADS syntax

n channel local (electrical) model:

```
model modelname pspnqs102e gender=1 <modpar>
componentname d g s b modelname<inpar>
```

p channel local (electrical) model:

```
model modelname pspnqs102e gender=0 <modpar>
componentname d g s b modelname<inpar>
```

n channel global (geometrical) model:

```
model modelname pspnqs1020 gender=1 <modpar>
componentname d g s b modelname<inpar>
```

p channel global (geometrical) model:

```
model modelname pspnqs1020 gender=0 <modpar>
componentname d g s b modelname<inpar>
```

n channel global (binning) model:

```
model modelname pspnqs1021 gender=1 <modpar>
componentname d g s b modelname<inpar>
```

p channel global (binning) model:

```
model modelname pspnqs1021 gender=0 <modpar>
componentname d g s b modelname<inpar>
```

modelname	:	name of model, user-defined.
componentname	:	occurrence indicator.
<modpar>	:	list of model parameters.
<inpar>	:	list of instance parameters.

d,g,s and b are drain, gate, source and bulk terminals respectively.

12.1.3 The ON/OFF condition for Pstar

The solution for a circuit involves a process of successive calculations. The calculations are started from a set of ‘initial guesses’ for the electrical quantities of the nonlinear elements. A simplified DCAPPROX mechanism for devices using ON/OFF keywords is mentioned in [1]. By default the devices start in the default state.

n-channel			
	Default	ON	OFF
V_{DS}	1.25	1.25	2.5
V_{GS}	1.25	1.25	0.0
V_{SB}	0.0	0.0	0.0
V_{DB}	0.0	0.0	0.0

p-channel			
	Default	ON	OFF
V_{DS}	-1.25	-1.25	-2.5
V_{GS}	-1.25	-1.25	0.0
V_{SB}	0.0	0.0	0.0
V_{DB}	0.0	0.0	0.0

12.1.4 The ON/OFF condition for Spectre

n-channel							
	OFF	Triode	Saturation	Subthreshold	Reverse	Forward	Breakdown
V_{DS}	0.0	0.75	1.25	2.0	0	0	0
V_{GS}	0.0	2.0	1.25	0.25	0	0	0
V_{SB}	0.0	0.0	0.0	0.0	0	0	0
V_{DB}	0.0	0.0	0.0	0.0	0.0	0.0	0.0

p-channel							
	OFF	Triode	Saturation	Subthreshold	Reverse	Forward	Breakdown
V_{DS}	0.0	-0.75	-1.25	-2.0	0	0	0
V_{GS}	0.0	-2.0	-1.25	-0.25	0	0	0
V_{SB}	0.0	0.0	0.0	0.0	0	0	0
V_{DB}	0.0	0.0	0.0	0.0	0.0	0.0	0.0

12.1.5 The ON/OFF condition for ADS

n-channel	
	Default
V_{DS}	0
V_{GS}	0
V_{SB}	0
V_{DB}	0

p-channel	
	Default
V_{DS}	0
V_{GS}	0
V_{SB}	0
V_{DB}	0

12.2References

- [1] R. van Langevelde and F.M. Klaassen, *Accurate Drain Conductance Modeling for Distortion Analysis in MOSFETs*, IEDM 1997 Tech. Digest, pp. 313-316, 1997.