

```
ankdes@BOOK-B1I8M2JVJ3: ~/explore/sky130CircuitDesignWorkshop/design/sky130_fd_pr/cells$ pwd
/home/ankdes@BOOK-B1I8M2JVJ3: ~/explore/sky130CircuitDesignWorkshop/design/sky130_fd_pr/cells
ankdes@BOOK-B1I8M2JVJ3: ~/explore/sky130CircuitDesignWorkshop/design/sky130_fd_pr/cells$ ls
nfet_01v8  pfet_01v8
ankdes@BOOK-B1I8M2JVJ3: ~/explore/sky130CircuitDesignWorkshop/design/sky130_fd_pr/cells$ cd nfet_01v8/
ankdes@BOOK-B1I8M2JVJ3: ~/explore/sky130CircuitDesignWorkshop/design/sky130_fd_pr/cells/nfet_01v8$ ls
sky130_fd_pr__nfet_01v8.pm3.spice          sky130_fd_pr__nfet_01v8__sf.corner.spice
sky130_fd_pr__nfet_01v8__ff.corner.spice   sky130_fd_pr__nfet_01v8__sf.pm3.spice
sky130_fd_pr__nfet_01v8__ff.pm3.spice      sky130_fd_pr__nfet_01v8__ss.corner.spice
sky130_fd_pr__nfet_01v8__fs.corner.spice   sky130_fd_pr__nfet_01v8__ss.pm3.spice
sky130_fd_pr__nfet_01v8__fs.pm3.spice      sky130_fd_pr__nfet_01v8__tt.corner.spice
sky130_fd_pr__nfet_01v8__mismatch.corner.spice sky130_fd_pr__nfet_01v8__tt.pm3.spice
ankdes@BOOK-B1I8M2JVJ3: ~/explore/sky130CircuitDesignWorkshop/design/sky130_fd_pr/cells/nfet_01v8$
```

The two cells covered in workshop

Different corners of nfet

```
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* SKY130 Spice File.
* Number of bins: 63
.param
+ sky130_fd_pr__nfet_01v8__toxe_mult = 1.0
+ sky130_fd_pr__nfet_01v8__rshn_mult = 1.0
+ sky130_fd_pr__nfet_01v8__overlap_mult = 0.9642
+ sky130_fd_pr__nfet_01v8__lint_diff = 0.0
+ sky130_fd_pr__nfet_01v8__wint_diff = 0.0
+ sky130_fd_pr__nfet_01v8__dlc_diff = -.61492e-9
+ sky130_fd_pr__nfet_01v8__dwc_diff = 0.0
*
* sky130_fd_pr__nfet_01v8, Bin 000, W = 1.26, L = 0.15
* -----
+ sky130_fd_pr__nfet_01v8__voff_diff_0 = 0.0
+ sky130_fd_pr__nfet_01v8__kt1_diff_0 = 0.0
+ sky130_fd_pr__nfet_01v8__ub_diff_0 = -1.1675e-19
+ sky130_fd_pr__nfet_01v8__pditsd_diff_0 = 0.0
+ sky130_fd_pr__nfet_01v8__ua_diff_0 = 1.3935e-11
+ sky130_fd_pr__nfet_01v8__vsat_diff_0 = 594.81
+ sky130_fd_pr__nfet_01v8__tvoff_diff_0 = 0.0
+ sky130_fd_pr__nfet_01v8__ags_diff_0 = 0.0
+ sky130_fd_pr__nfet_01v8__a0_diff_0 = 0.0
+ sky130_fd_pr__nfet_01v8__b0_diff_0 = 0.0
+ sky130_fd_pr__nfet_01v8__pclm_diff_0 = 0.0
+ sky130_fd_pr__nfet_01v8__pdits_diff_0 = 0.0
+ sky130_fd_pr__nfet_01v8__keta_diff_0 = 0.0
+ sky130_fd_pr__nfet_01v8__rdsd_diff_0 = 0.0
+ sky130_fd_pr__nfet_01v8__k2_diff_0 = 0.0031843
+ sky130_fd_pr__nfet_01v8__vth0_diff_0 = -0.024441
+ sky130_fd_pr__nfet_01v8__nfactor_diff_0 = 0.37668
+ sky130_fd_pr__nfet_01v8__u0_diff_0 = -0.0034894
+ sky130_fd_pr__nfet_01v8__eta0_diff_0 = 0.0
+ sky130_fd_pr__nfet_01v8__b1_diff_0 = 0.0
*
* sky130_fd_pr__nfet_01v8, Bin 001, W = 1.68, L = 0.15
* -----
+ sky130_fd_pr__nfet_01v8__eta0_diff_1 = 0.0
+ sky130_fd_pr__nfet_01v8__b1_diff_1 = 0.0
+ sky130_fd_pr__nfet_01v8__voff_diff_1 = 0.0
+ sky130_fd_pr__nfet_01v8__kt1_diff_1 = 0.0
+ sky130_fd_pr__nfet_01v8__ub_diff_1 = -1.6979e-19
+ sky130_fd_pr__nfet_01v8__pditsd_diff_1 = 0.0
+ sky130_fd_pr__nfet_01v8__ua_diff_1 = 1.0381e-11
+ sky130_fd_pr__nfet_01v8__vsat_diff_1 = 249.83
"sky130_fd_pr__nfet_01v8__tt.corner.spice" 1474 lines --3%--
```

Specific W, L

Model params

Params differ for W, L

For designs with sky130, we need to select these corners only.

One of the corner files

```
***** SkyWater sky130 model library *****
* Typical corner (tt)
lib tt
* MOSFET
include "../cells/nfet_01v8/sky130_fd_pr__nfet_01v8__tt.corner.spice"
include "../cells/pfet_01v8/sky130_fd_pr__pfet_01v8__tt.corner.spice"
* Mismatch parameters
include "../cells/nfet_01v8/sky130_fd_pr__nfet_01v8__mismatch.corner.spice"
include "../cells/pfet_01v8/sky130_fd_pr__pfet_01v8__mismatch.corner.spice"
* All models
include "all.spice"
endl

* Slow-Fast corner (sf)
lib sf
* MOSFET
include "../cells/nfet_01v8/sky130_fd_pr__nfet_01v8__sf.corner.spice"
include "../cells/pfet_01v8/sky130_fd_pr__pfet_01v8__sf.corner.spice"
* Mismatch parameters
include "../cells/nfet_01v8/sky130_fd_pr__nfet_01v8__mismatch.corner.spice"
include "../cells/pfet_01v8/sky130_fd_pr__pfet_01v8__mismatch.corner.spice"
* All models
include "all.spice"
endl

* Fast-Fast corner (ff)
lib ff
* MOSFET
include "../cells/nfet_01v8/sky130_fd_pr__nfet_01v8__ff.corner.spice"
include "../cells/pfet_01v8/sky130_fd_pr__pfet_01v8__ff.corner.spice"
* Mismatch parameters
include "../cells/nfet_01v8/sky130_fd_pr__nfet_01v8__mismatch.corner.spice"
include "../cells/pfet_01v8/sky130_fd_pr__pfet_01v8__mismatch.corner.spice"
"sky130.lib.spice" 79L, 2640B
```

Defines a specific corner

Both FETS

Library file

```
.param temp=27

*Including sky130 library files
.lib "sky130_fd_pr/models/sky130.lib.spice" tt

*Netlist Description
Name Drain Gate Source Bulk
XM1 Vdd n1 0 0 sky130_fd_pr__nfet_01v8 w=5 l=2

R1 n1 in 55

Vdd vdd 0 1.8V
Vin in 0 1.8V

*simulation commands
.op
.dc Vdd 0 1.8 0.1 Vin 0 1.8 0.2

.control
run
display
setplot dcl
.endc

.end
```

Annotations:

- A + tt (typical corner)
- Selecting one of the W, L values
- model name
- Supply voltage 1.8V
- V_{Gs} sweeping
- We are doing V_{Ds} vs V_{Gs} curve for DC
- V_{Ds} Sweeping from 0 to 1.8 with stepsize of 0.1

Workshop spice file

/home/ankdesh/explore/sky130CircuitDesignWorkshop/design/day1_nfet_idvds_L2_W5.spice
Press ENTER or type command to continue

```
ankdesh@BOOK-B1I8M2JVJ3: x + v
```

```
** The U. C. Berkeley CAD Group  
** Copyright 1985-1994, Regents of the University of California.  
** Copyright 2001-2020, The ngspice team.  
** Please get your ngspice manual from http://ngspice.sourceforge.net/docs.html  
** Please file your bug-reports at http://ngspice.sourceforge.net/bugrep.html  
** Creation Date: Mon Mar 11 21:44:53 UTC 2024  
*****  
No compatibility mode selected!
```

Executing ngspice day! - spice

```
Circuit: *model description  
  
Doing analysis at TEMP = 27.000000 and TNOM = 27.000000  
  
Reference value : 0.00000e+00  
No. of Data Rows : 190  
  
No. of Data Rows : 1  
Here are the vectors currently active:  
  
Title: *model description  
Name: op1 (Operating Point)  
Date: Sun Aug 3 18:24:05 2025  
  
in          : voltage  
m.xml.msky130_fd_pr_nfet_01v : voltage  
m.xml.msky130_fd_pr_nfet_01v : voltage  
m.xml.msky130_fd_pr_nfet_01v : voltage  
n1          : voltage  
vdd         : voltage  
vdd#branch  : current  
vin#branch  : current  
  
ngspice 1 ->  
ngspice 1 ->  
ngspice 1 ->  
ngspice 1 ->  
ngspice 1 ->  
ngspice 1 ->  
ngspice 1 ->  
ngspice 1 ->  
ngspice 1 ->  
ngspice 1 ->  
ngspice 1 ->  
ngspice 1 ->  
ngspice 1 ->  
ngspice 1 ->  
ngspice 1 -> plot -vdd#branch  
Warning: Missing charsets in String to FontSet conversion  
ngspice 2 ->  
x0 = 1.01111, y0 = 0.000273239
```

The graph shows multiple red curves representing current (UA) vs. voltage sweep (V). A green circle on one of the curves indicates a point where values can be retrieved.

