

# Noise Margin



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# Procedure

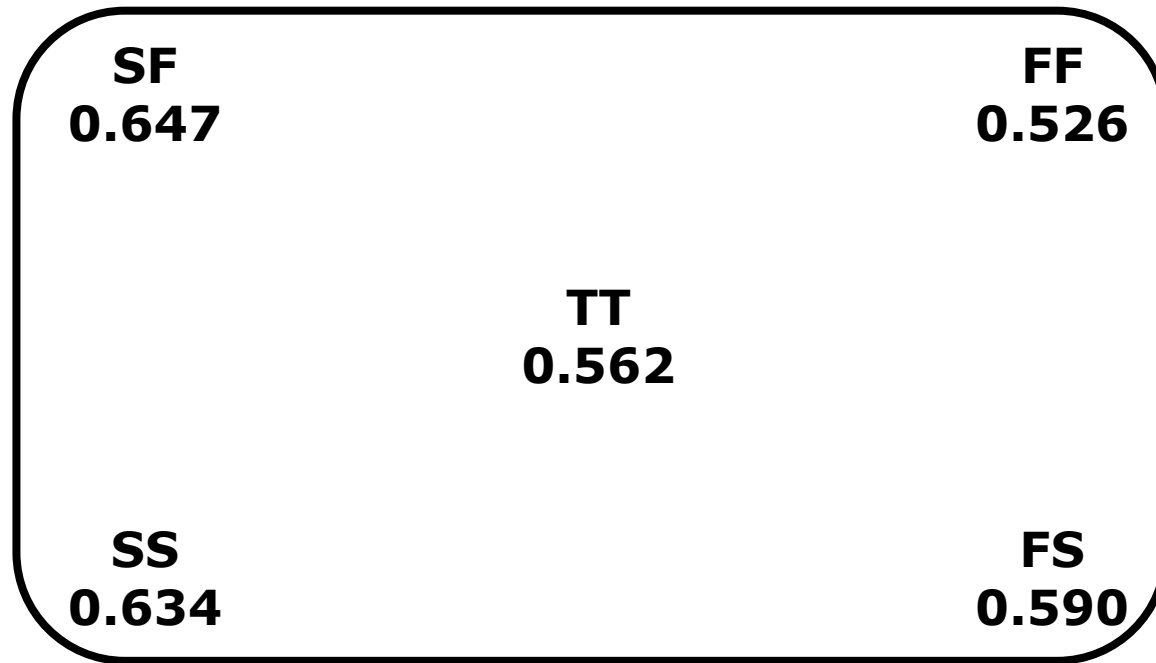
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- ❑ Hspice simulation
- ❑ Download data
- ❑ Post-processing done by python
  - Rotate the curves ccw by 45 degree
  - Subtract two curves
  - Find min(local maximum, -local minimum) for SNM, RNM
  - Find local maximum (or global maximum) for WNM

# SNM (corners)

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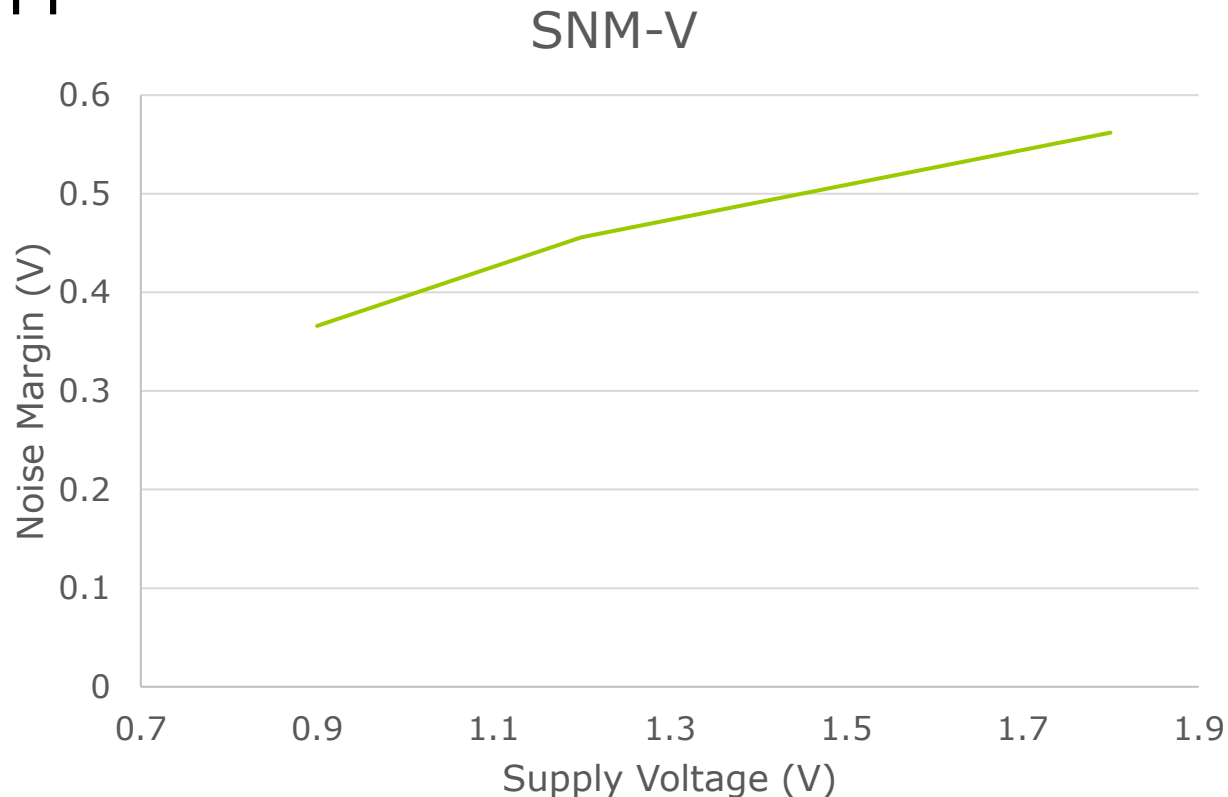
□ Best at SF, worst at FF



# SNM (supply voltage)

□ Roughly linear to VDD

■ At TT



# SNM (width)

□ Noise margin ↑ with  $W_n$  ↓ or  $W_p$  ↑

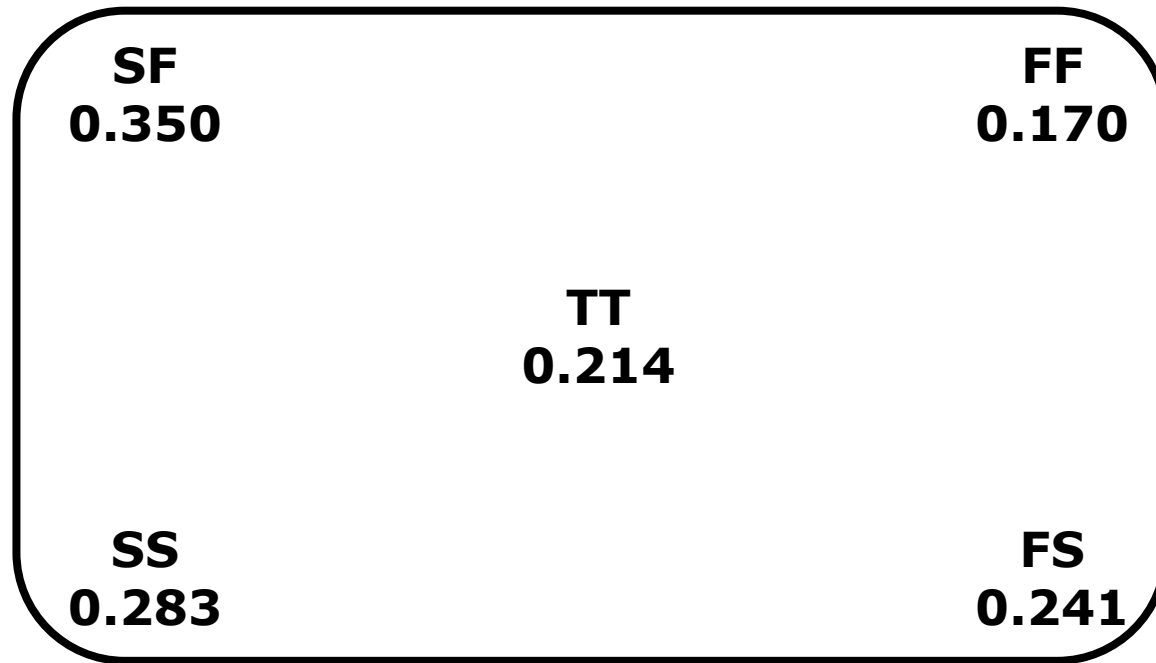
■  $V_{DD} = 1.8 \text{ V}$

	$W_p = 0.25 \text{ um}$ 0.533	
$W_n = 0.62 \text{ um}$ 0.564	$W_n = 0.72 \text{ um}$ $W_p = 0.30 \text{ um}$ 0.562	$W_n = 0.82 \text{ um}$ 0.560
	$W_p = 0.35 \text{ um}$ 0.569	

# RNM (corners)

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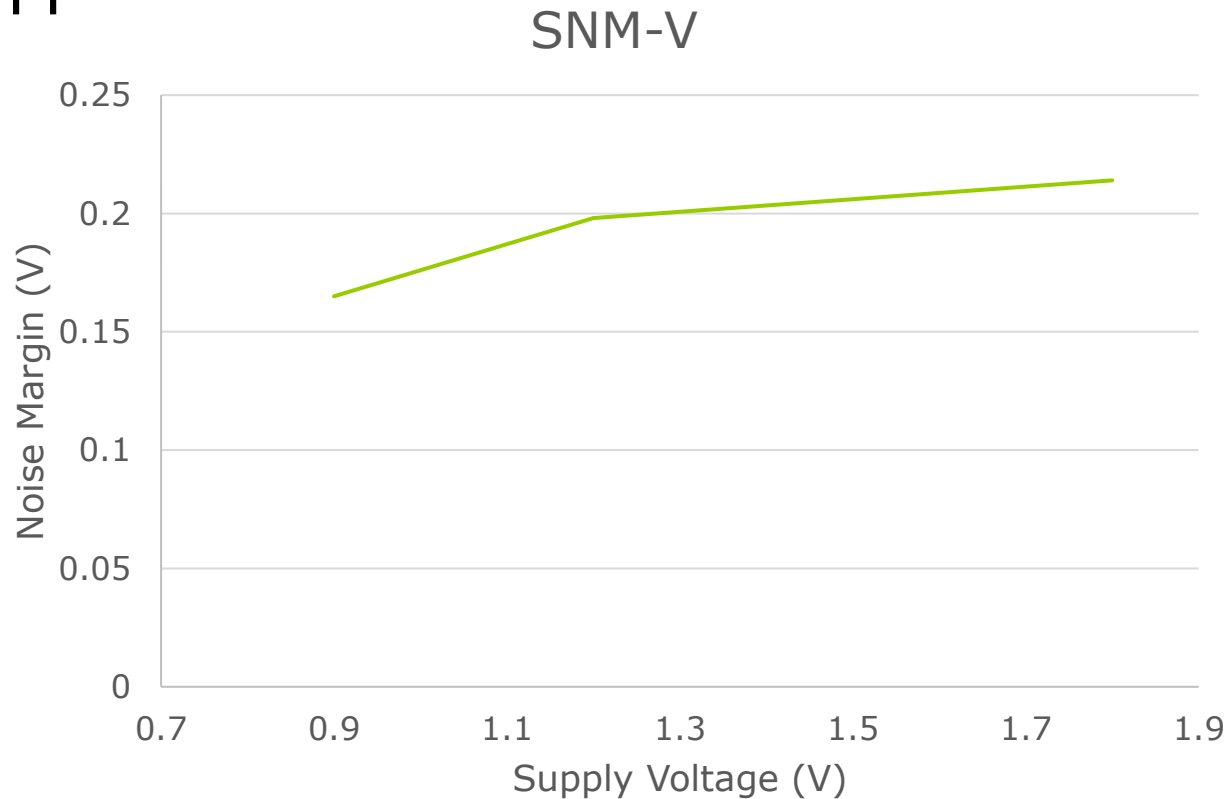
□ Best at SF, worst at FF



# RNM (supply voltage)

□ NM ↓ with VDD ↓

■ At TT



# RNM (width)

□ Noise margin ↑ with  $W_n$  ↓ or  $W_p$  ↑

■  $V_{DD} = 1.8 \text{ V}$

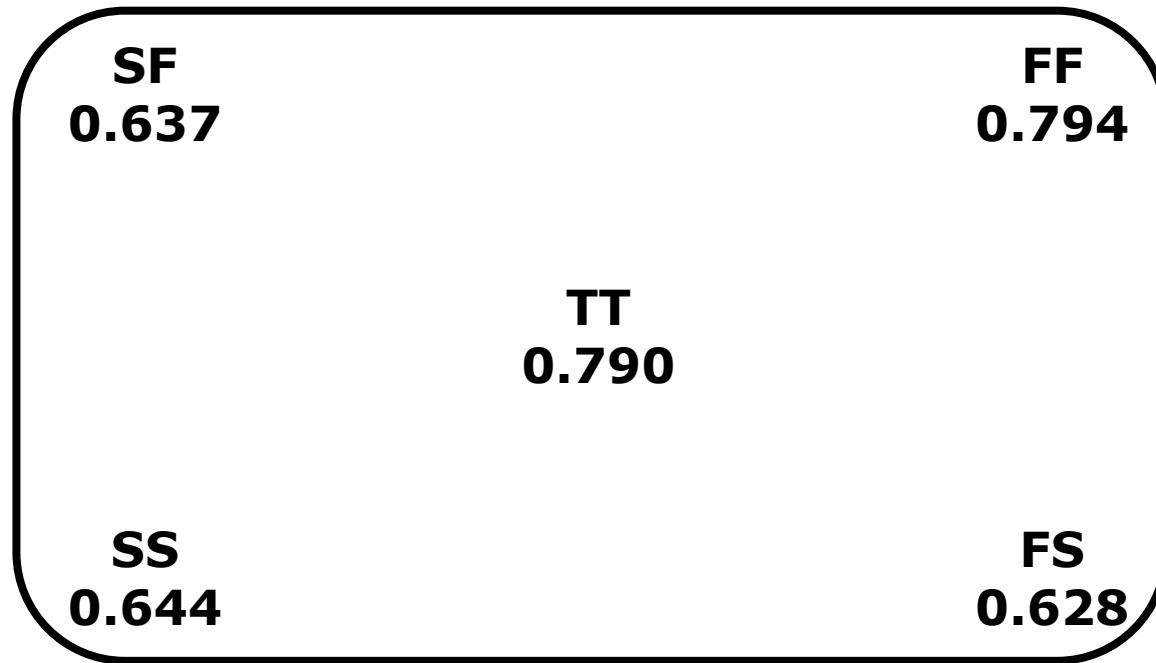
	$W_p = 0.24 \text{ um}$ 0.196	
$W_n = 0.60 \text{ um}$ 0.167	$W_n = 0.72 \text{ um}$ $W_p = 0.30 \text{ um}$ 0.214	$W_n = 0.84 \text{ um}$ 0.237
	$W_p = 0.36 \text{ um}$ 0.216	



# WNM (corners)

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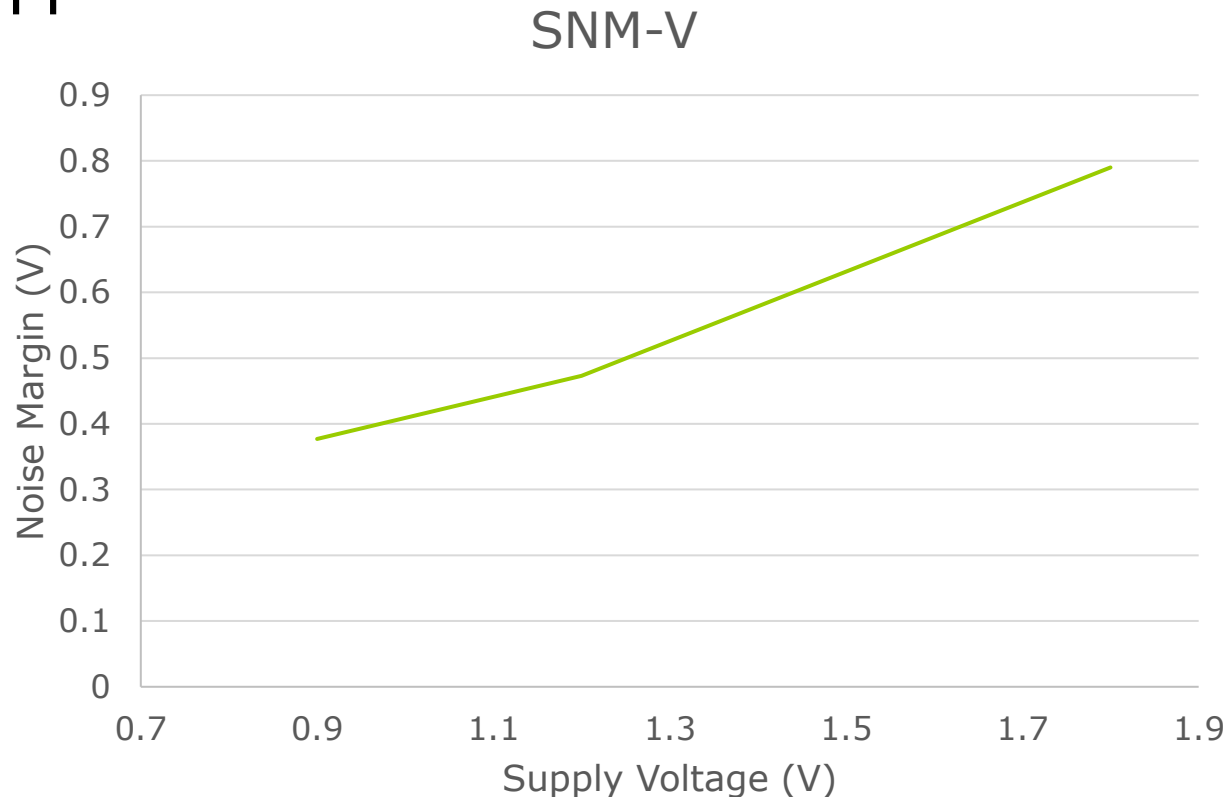
□ Best at FF, worst at FS



# WNM (supply voltage)

□ Roughly linear to VDD

■ At TT



# WNM (width)

□ Noise margin  $\uparrow$  with  $W_n \downarrow$  or  $W_p \uparrow$

■  $V_{DD} = 1.2 \text{ V}$

	$W_p = 0.25 \text{ um}$ 0.472	
$W_n = 0.60 \text{ um}$ 0.475	$W_n = 0.72 \text{ um}$ $W_p = 0.30 \text{ um}$ 0.473	$W_n = 0.84 \text{ um}$ 0.471
	$W_p = 0.36 \text{ um}$ 0.473	

## Some special cases

