SDE COMMANDS

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; Geometry and Material Definition

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; Define the substrate region (Silicon Substrate)

(sdegeo:create-rectangle (position 0 0 0) (position 0.25 0.4 0) "Silicon" "Substrate")

; Define the source region (n+ doped Silicon Source)

(sdegeo:create-rectangle (position 0 0.05 0) (position 0.05 0.15 0) "Silicon" "Source")

; Define the drain region (n+ doped Silicon Drain)

(sdegeo:create-rectangle (position 0 0.25 0) (position 0.05 0.35 0) "Silicon" "Drain")

; Define the source contact (Aluminum Contact on Source)

(sdegeo:create-rectangle (position 0 0.05 0) (position -0.005 0.11 0) "Aluminum" "Contact\_Source")

; Define the drain contact (Aluminum Contact on Drain)

(sdegeo:create-rectangle (position 0 0.29 0) (position -0.005 0.35 0) "Aluminum" "Contact\_Drain")

; Define the oxide layer (SiO2 Gate Oxide)

(sdegeo:create-rectangle (position 0 0.11 0) (position -0.002 0.29 0) "SiO2" "Oxide\_thickness")

; Define the gate region (PolySilicon Gate)

(sdegeo:create-rectangle (position -0.002 0.15 0) (position -0.02 0.25 0) "PolySilicon" "Gate")

; Define sidewall nitride layers (Si3N4 Sidewalls)

(sdegeo:create-rectangle (position -0.002 0.11 0) (position -0.06 0.15 0) "Si3N4" "Nitride1")

(sdegeo:create-rectangle (position -0.002 0.25 0) (position -0.06 0.29 0) "Si3N4" "Nitride2")

; Add rounded corners to nitride layers for realistic geometry

(sdegeo:fillet-2d (list (car (find-vertex-id (position -0.06 0.29 0)))) 0.03)

(sdegeo:fillet-2d (list (car (find-vertex-id (position -0.06 0.11 0)))) 0.03)

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; Doping Profiles and Regions Definition

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; Substrate doping (p-type Boron)

(sdedr:define-constant-profile "Substrate\_Doping" "BoronActiveConcentration" @sub\_doping@)

(sdedr:define-constant-profile-region "Substrate\_Doping" "Substrate\_Doping" "Substrate")

; Source doping (n+ Phosphorus)

(sdedr:define-constant-profile "Source\_Doping" "PhosphorusActiveConcentration" 1e+20)

(sdedr:define-constant-profile-region "Source\_Doping" "Source\_Doping" "Source")

; Drain doping (n+ Phosphorus)

(sdedr:define-constant-profile "Drain\_Doping" "PhosphorusActiveConcentration" 1e+20)

(sdedr:define-constant-profile-region "Drain\_Doping" "Drain\_Doping" "Drain")

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; Contact and Bias Definition

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; Define source contact

(sdegeo:define-contact-set "source" 4 (color:rgb 1 0 0) "##")

(sdegeo:set-contact (list (car (find-edge-id (position 0 0.08 0)))) "source")

; Define drain contact

(sdegeo:define-contact-set "drain" 4 (color:rgb 1 0 0) "##")

(sdegeo:set-contact (list (car (find-edge-id (position 0 0.32 0)))) "drain")

; Define gate contact

(sdegeo:define-contact-set "gate" 4 (color:rgb 1 0 0) "##")

(sdegeo:set-contact (list

(car (find-edge-id (position -0.02 0.2 0)))

(car (find-edge-id (position -0.04 0.15 0)))

(car (find-edge-id (position -0.04 0.25 0)))) "gate")

; Define bulk contact

(sdegeo:define-contact-set "bulk" 4 (color:rgb 1 0 0) "##")

(sdegeo:set-contact (list (car (find-edge-id (position 0.25 0.2 0)))) "bulk")

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; Mesh Refinement Setup

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; Substrate mesh refinement

(sdedr:define-refeval-window "Mesh\_Substrate" "Rectangle" (position 0 0 0) (position 0.25 0.4 0))

(sdedr:define-refinement-size "Mesh\_Substrate\_Ref\_Def" 0.0035 0.0035 0 0.0025 0.0025 0)

(sdedr:define-refinement-placement "Mesh\_Substrate\_Ref" "Mesh\_Substrate\_Ref\_Def" (list "region" "Substrate"))

; Source mesh refinement

(sdedr:define-refeval-window "Source\_Mesh" "Rectangle" (position 0 0.05 0) (position 0.05 0.15 0))

(sdedr:define-refinement-size "Mesh\_Source\_Ref\_Def" 0.0025 0.0025 0 0.001 0.001 0)

(sdedr:define-refinement-placement "Mesh\_Source\_Ref" "Mesh\_Source\_Ref\_Def" (list "region" "Source"))

; Drain mesh refinement

(sdedr:define-refeval-window "Drain\_Mesh" "Rectangle" (position 0 0.25 0) (position 0.05 0.35 0))

(sdedr:define-refinement-size "Mesh\_Drain\_Ref\_Def" 0.0025 0.0025 0 0.001 0.001 0)

(sdedr:define-refinement-placement "Mesh\_Drain\_Ref" "Mesh\_Drain\_Ref\_Def" (list "region" "Drain"))

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; Simulation Commands

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; Build the device mesh

(sde:build-mesh "n@node@\_msh")

; Run the simulation with specified parameters

(system:command "tdx -mtt -x -M 0 -S 0 -ren drain=source n@node@\_msh")