ESD PADS

for DEEP Submicron design

rules using TSMC CL018 process

λ = 90 nm

Technology code:

SCN6M_DEEP

Electric Technology: mocmos

(submicron)

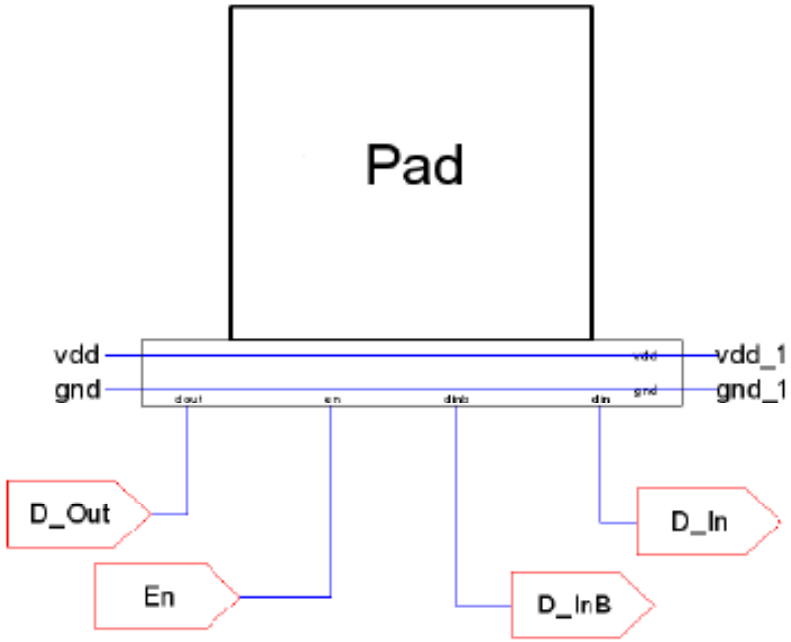
List of Pads

- Digital Input/Output pad
- Analog pad
- VDD pad
- GND pad

All digital pads contain following pins:

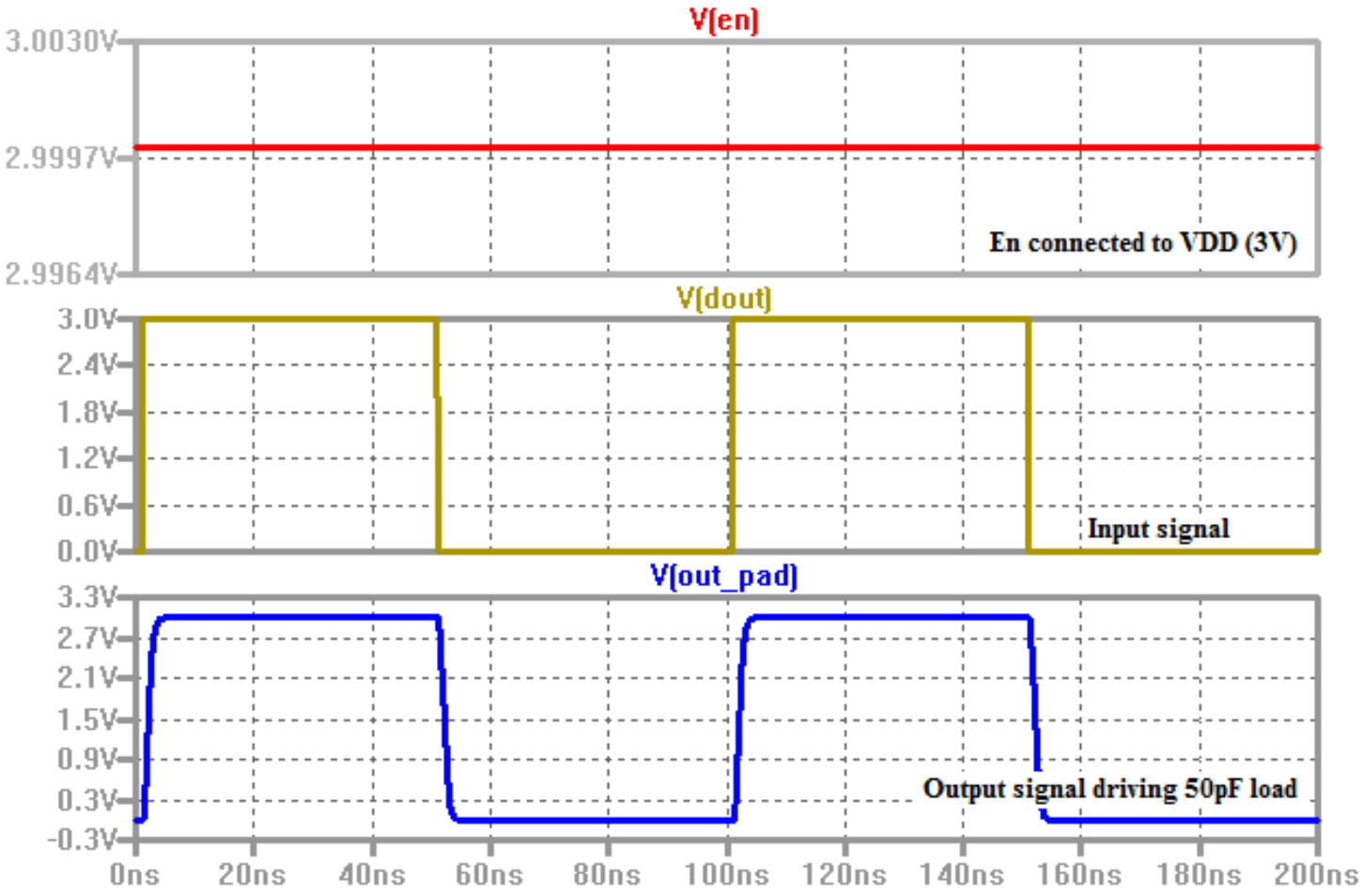
- Inputs: En, D_Out
- Outputs: D_In, D_InB
- Bidirectional pin: pad
- Power: vdd
- Ground: gnd

Using Digital Input/Output pad for signals coming on to the chip

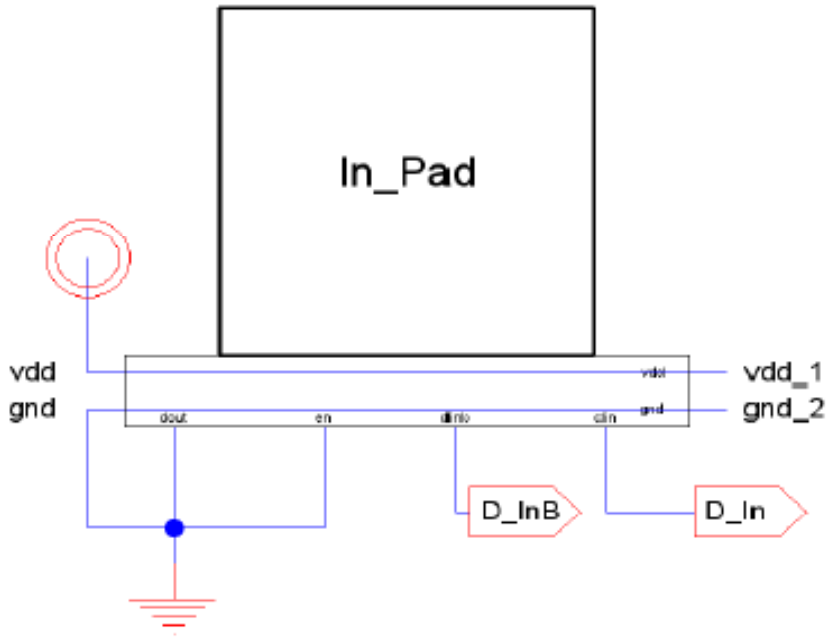


- Connect En to VDD.
- Connect D_Out to the input signal.
- Pad is the output.

Simulation of Input/Output pad used for signals coming on to the chip

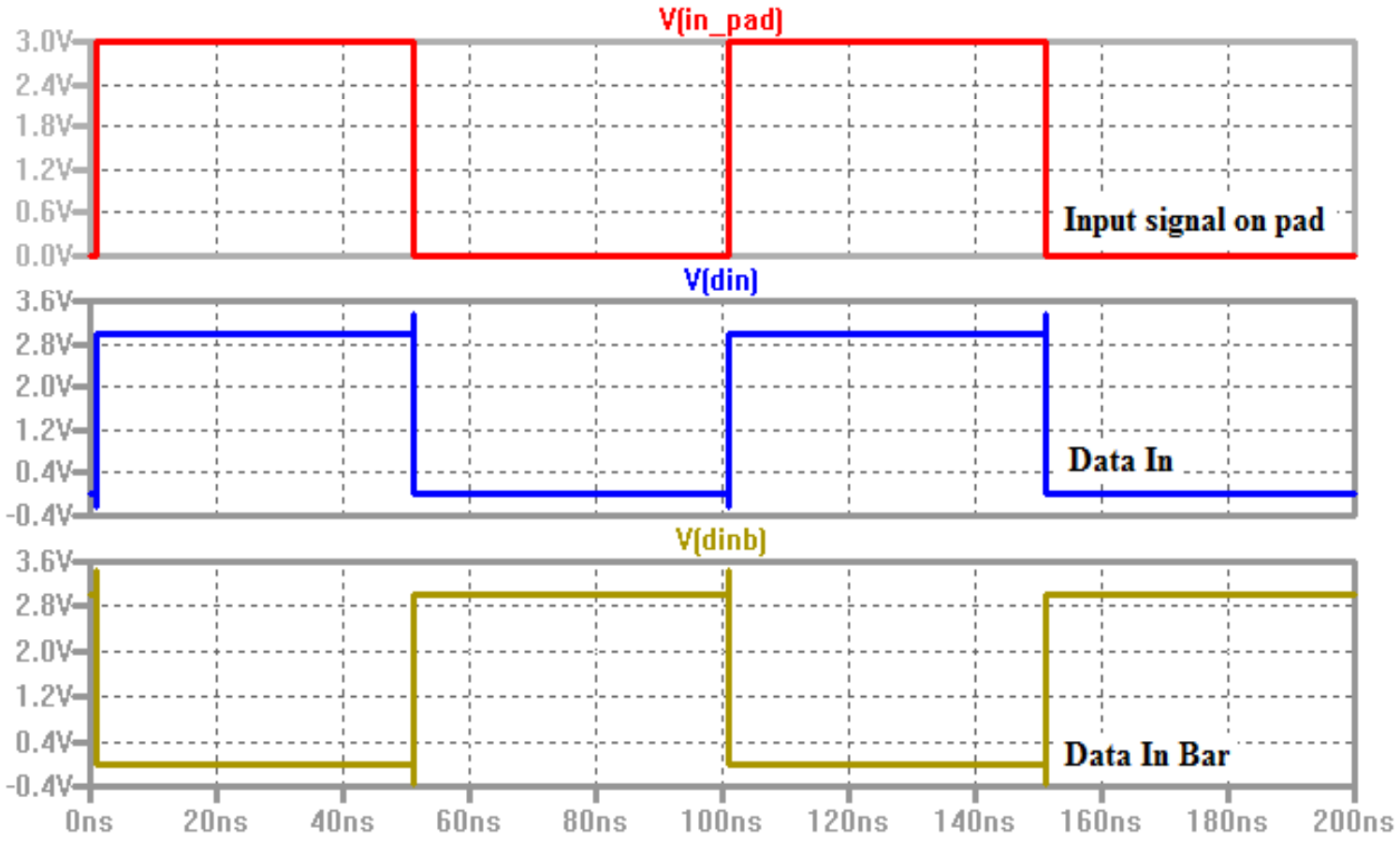


Using Digital Input/Output pad for **driving signals off-chip**

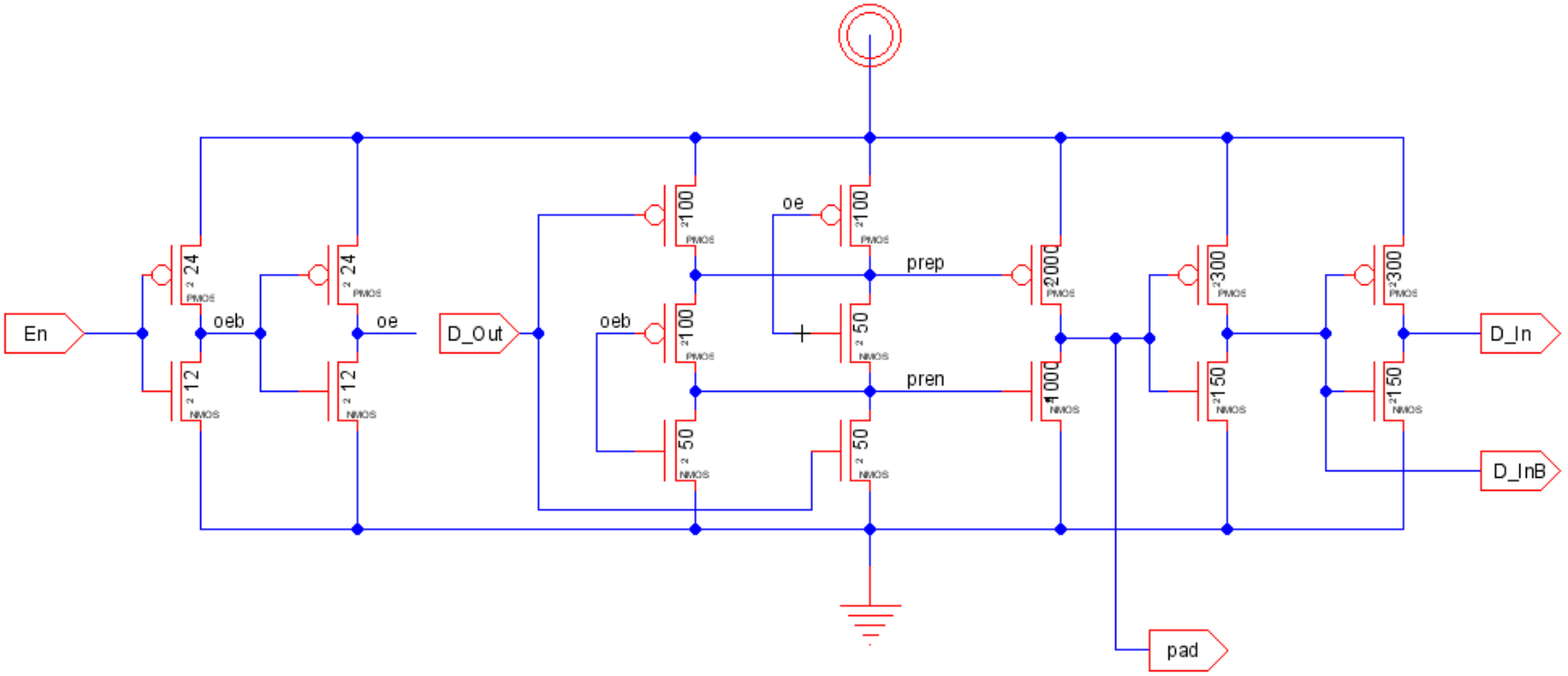


- En is connected to gnd.
- D_Out is a don't care, here it is connected to ground but it could be floating (unconnected).
- The input signal is connected to the pad and the output will be available at D_In. D_InB is the inverted signal of D_In.

Simulation of Input/Output pad for providing signals off-chip



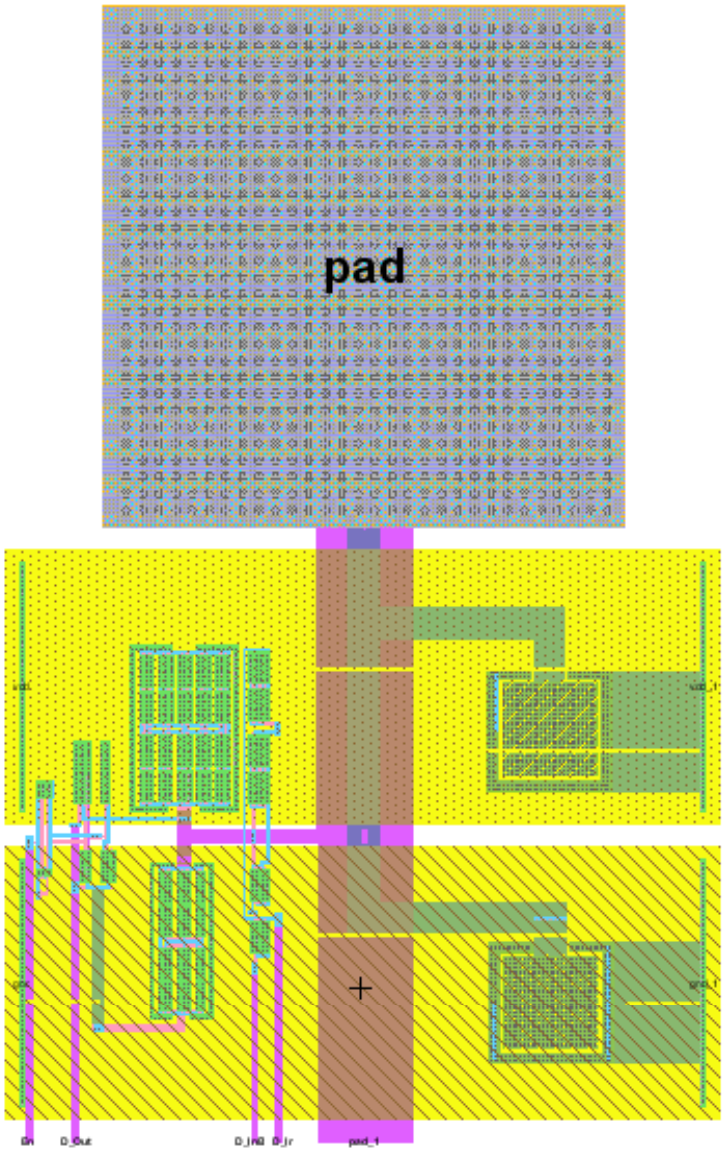
Digital Input/Output Pad Schematic

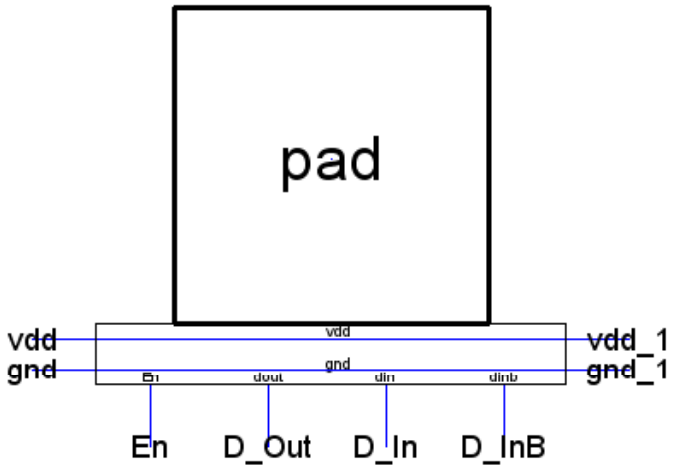


As explained in the previous slides,

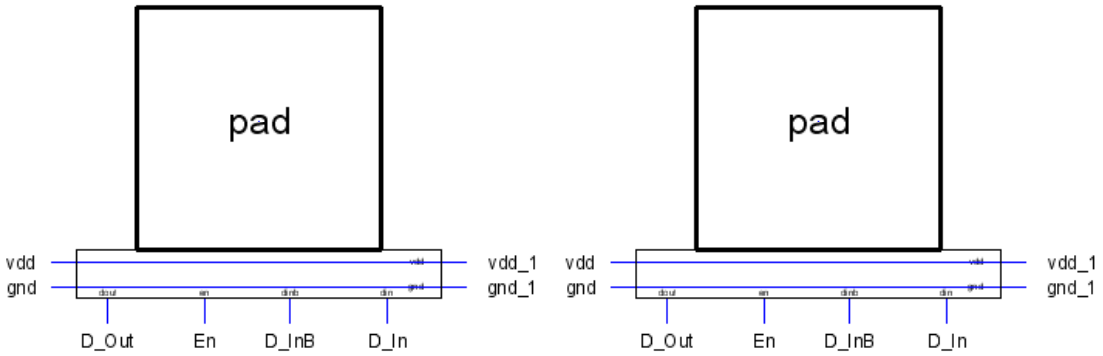
- En and D_Out are the input signals, while pad, D_In, and D_InB are output signals.
- Using the pad as an input requires En to be grounded and D_out as don't care. The input signal is provided on pad and the output will be available at D_In.
- Using the pad as an output requires En to be connected to the power (vdd) and D_Out should be connected to the input signal while the output appears on the pad.

Layout and Icon view of Input/Output pad

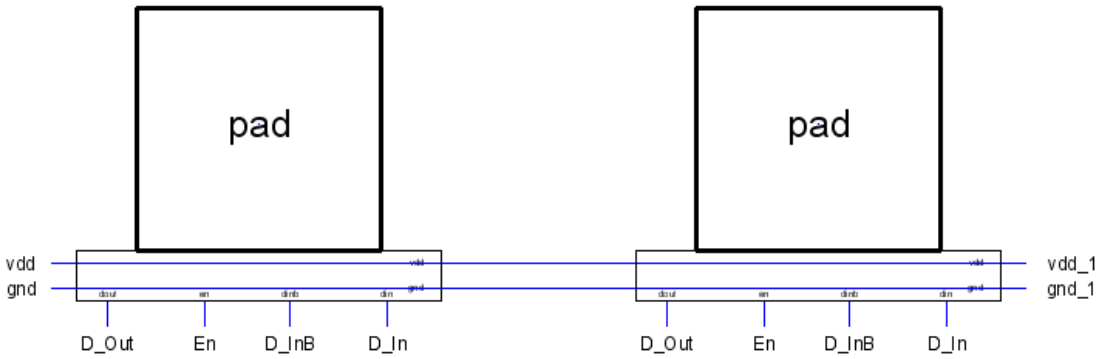




Connecting two pads together

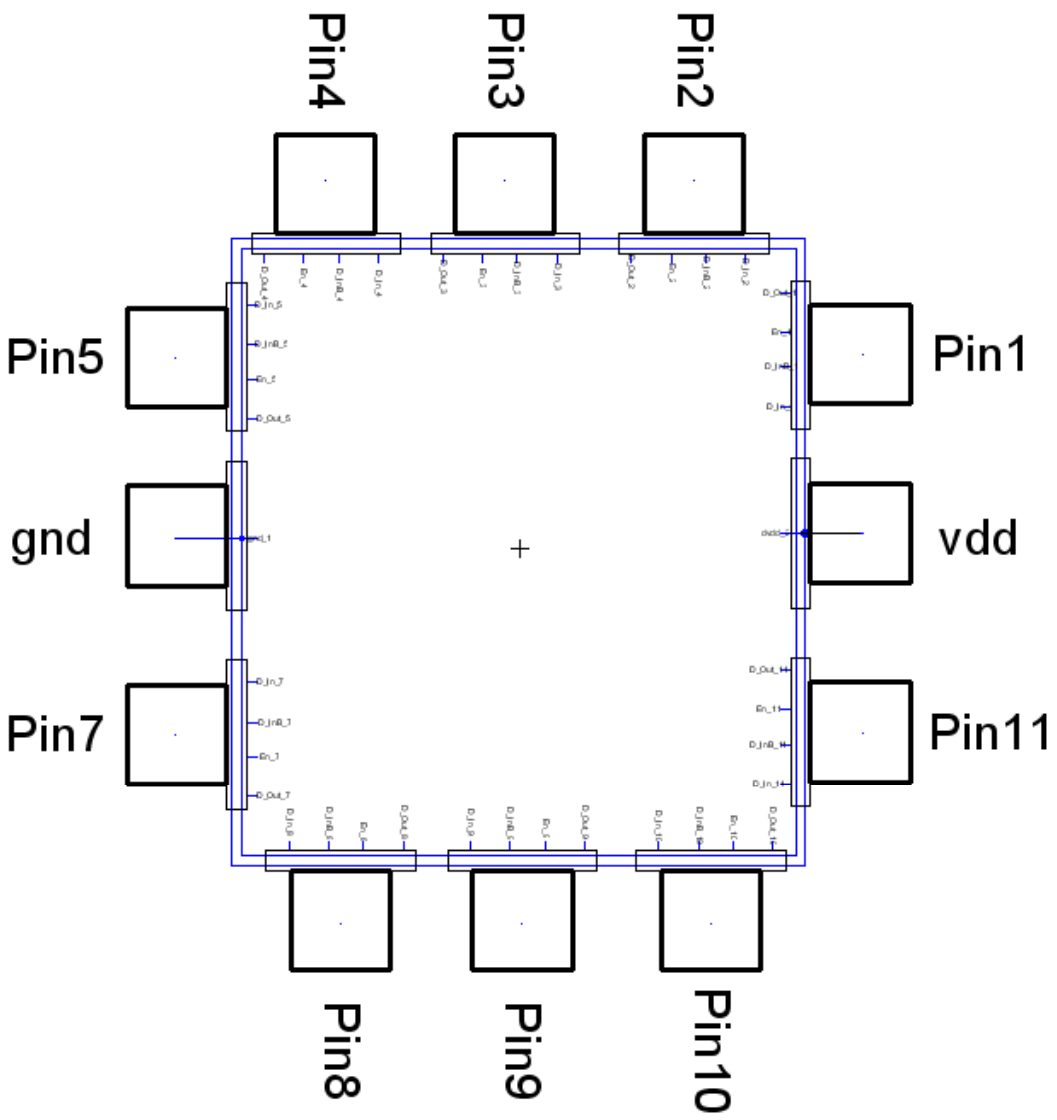


A) Take the icon of the Input/Output pad and copy it.

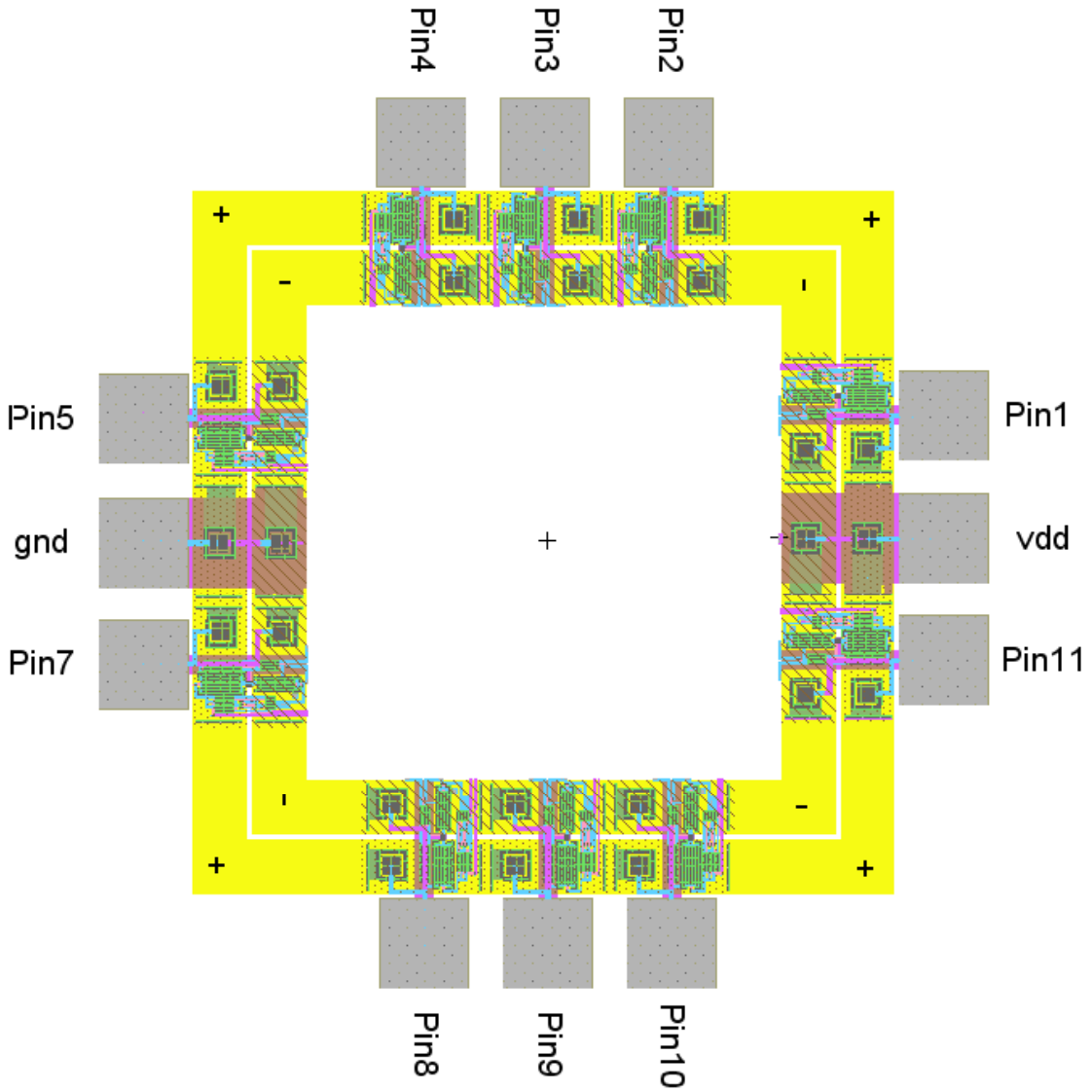


B) Connect the vdd and gnd connections of two pads.

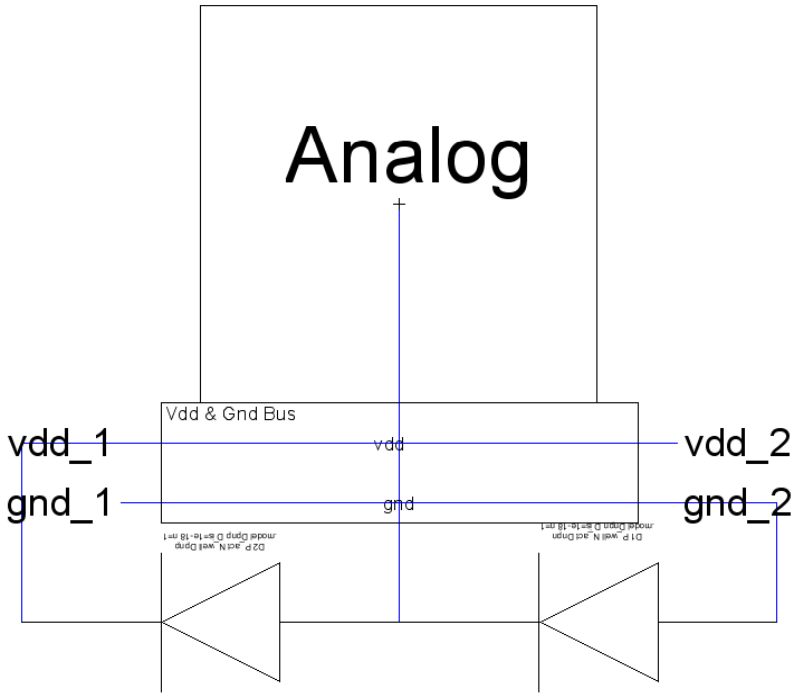
12 Pin pad frame using Input/output pads



12 Pin pad frame Layout using input/output pads

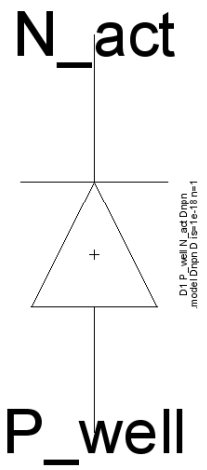


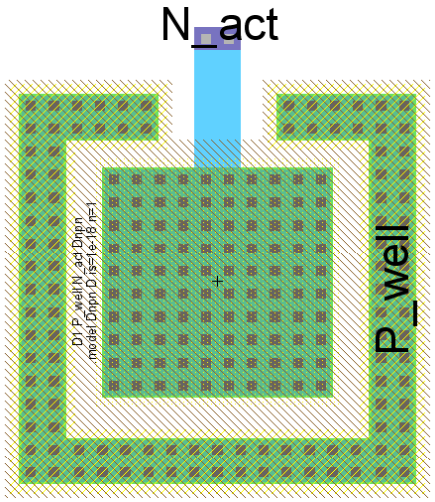
Analog Pad



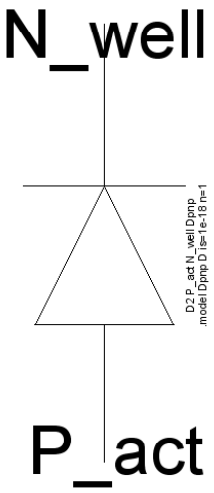
The pad contains diodes for ESD (Electrostatic Discharge) Protection. When the pad gets voltage higher than VDD, the P_act to Nwell diode turns on and supplies the extra voltage to vdd source. Similarly if the pad gets voltage lower than ground (negative voltage), the N_act to Pwell diode turns on supplying the negative voltage to the ground. Both the diodes protect the pad from damages.

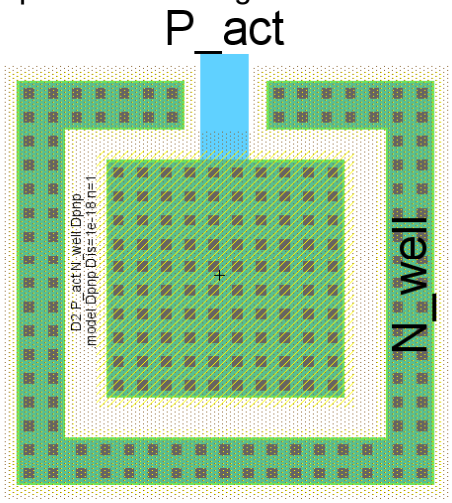
ESD diodes and Layout





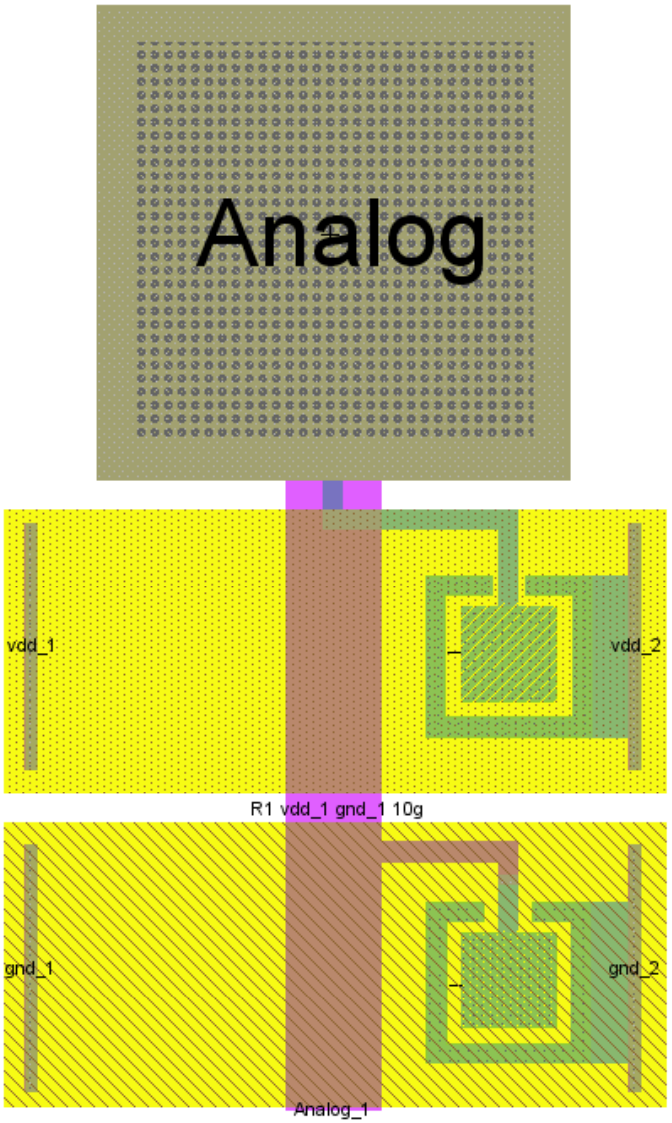
N_act is connected to pad and p_well is connected to ground. If the voltage on pad goes below ground (0 volt) the diode turns on and drives the negative voltage to ground preventing the pad from damage.

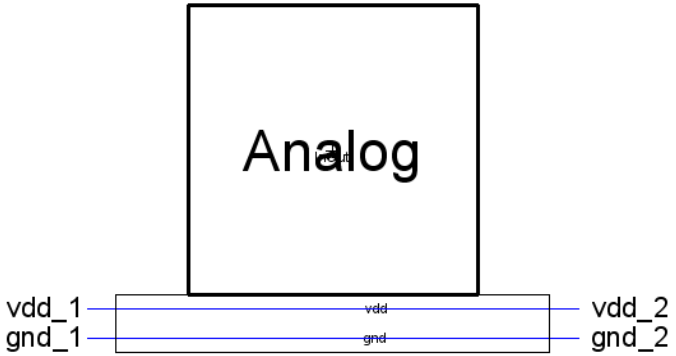




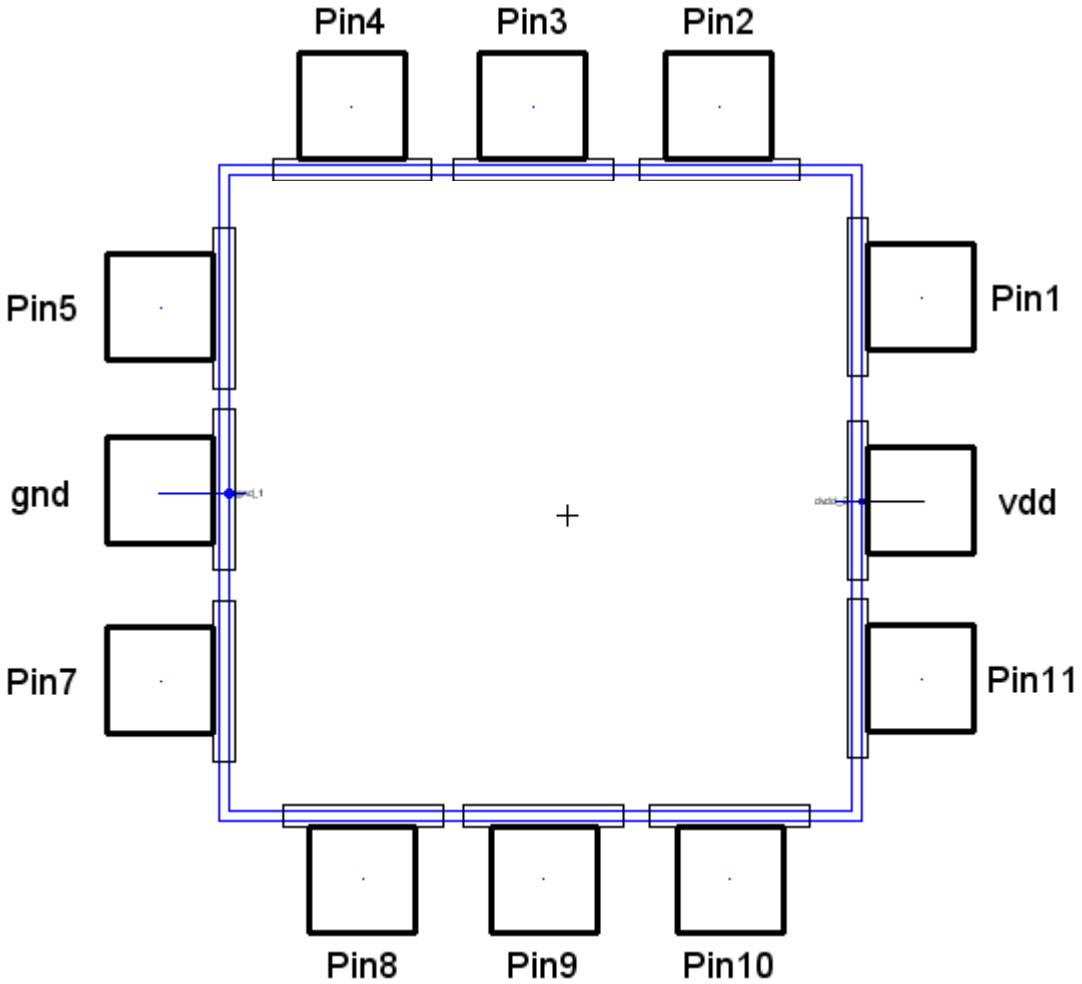
P_act is connected to pad and n_well is connected to power. If the voltage on pad goes above vdd (5 volt) the diode turns on and drives the extra voltage to power preventing the pad from damage.

Layout and Icon view of analog pad





12 Pin pad frame using analog pads



12 Pin pad frame Layout using analog pads