

# Diode

Last updated 3/12/19

# Diode

- P-N Diode Characteristics
  - No bias



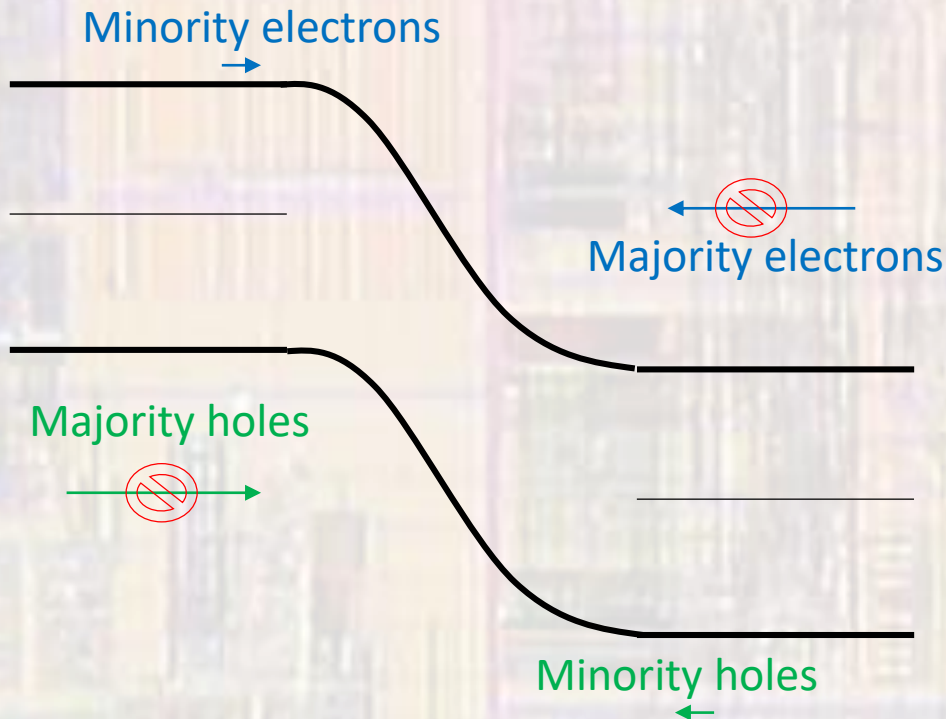
$$\phi_{bi} = \phi_P + \phi_N = \frac{q}{kT} \log\left(\frac{n}{n_i}\right) + \frac{q}{kT} \log\left(\frac{p}{n_i}\right)$$

# Diode

- P-N Diode Characteristics

- Reverse bias

- Minority Carrier concentrations are very small
  - Small reverse bias (leakage) current
- Majority carriers are blocked by the potential barrier



$$I_d = -I_S$$

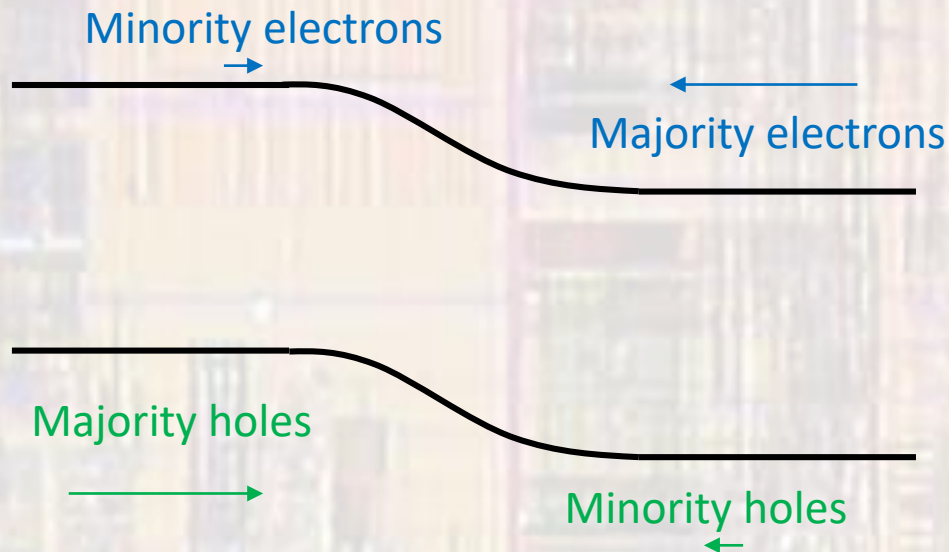
$$I_S = \left[ q \frac{D_n n_i^2}{L_n N_A} + q \frac{D_p n_i^2}{L_p N_D} \right] A$$

# Diode

- P-N Diode Characteristics

- Forward bias

- Minority Carrier concentrations are very small
  - Small contribution to current
- Significant numbers of majority carriers have enough energy to traverse the potential barrier (exponential wrt. bias)



$$I_d = I_S \left( e^{\frac{qV}{kT}} - 1 \right)$$

# Diode

SiO<sub>2</sub>

Si with natural Oxide growth



Deposit thick oxide

SiO<sub>2</sub>



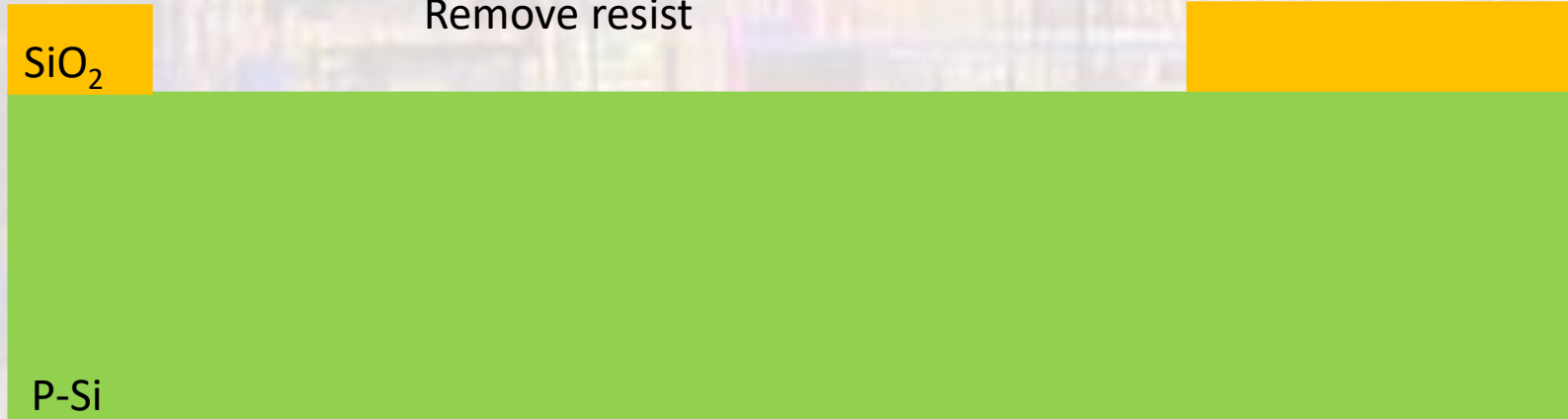


# Diode



# Diode

Etch oxide  
Remove resist



N type implant/diffusion and drive



# Diode

Strip (?) and Deposit Oxide





# Diode

Expose (pattern) and rinse



Etch oxide  
Remove resist



# Diode

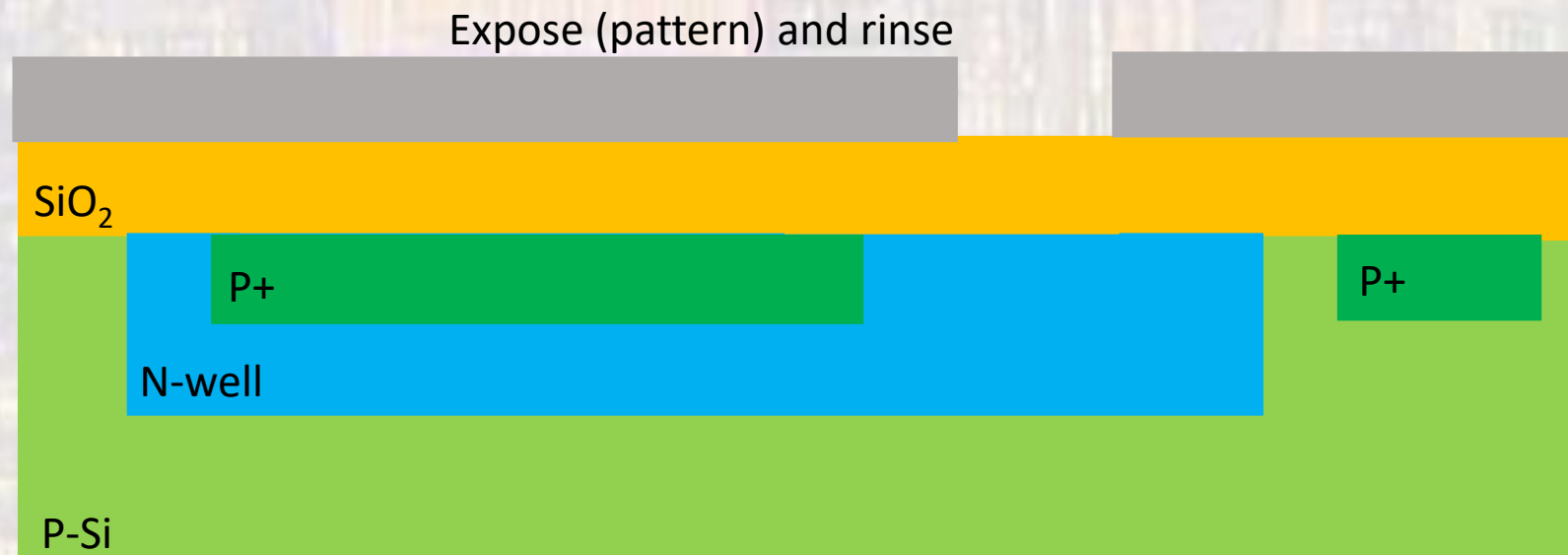
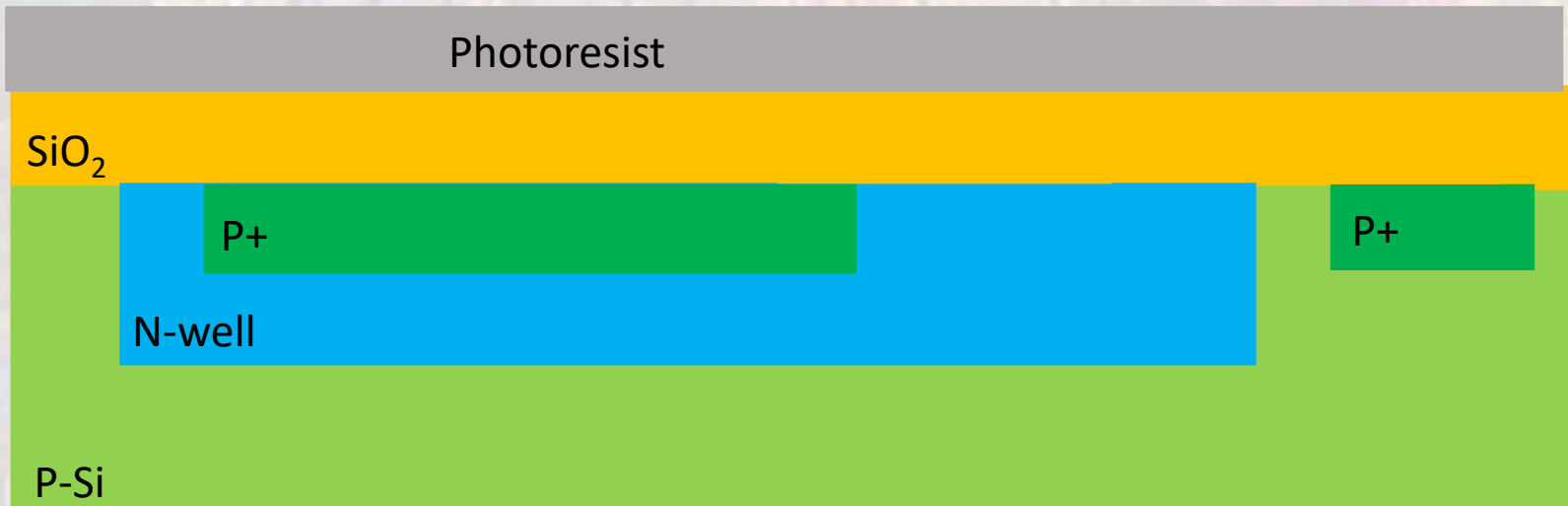
P Type implant/diffusion and Drive



Strip(?) and deposit oxide



# Diode



# Diode

Etch oxide  
Remove Resist

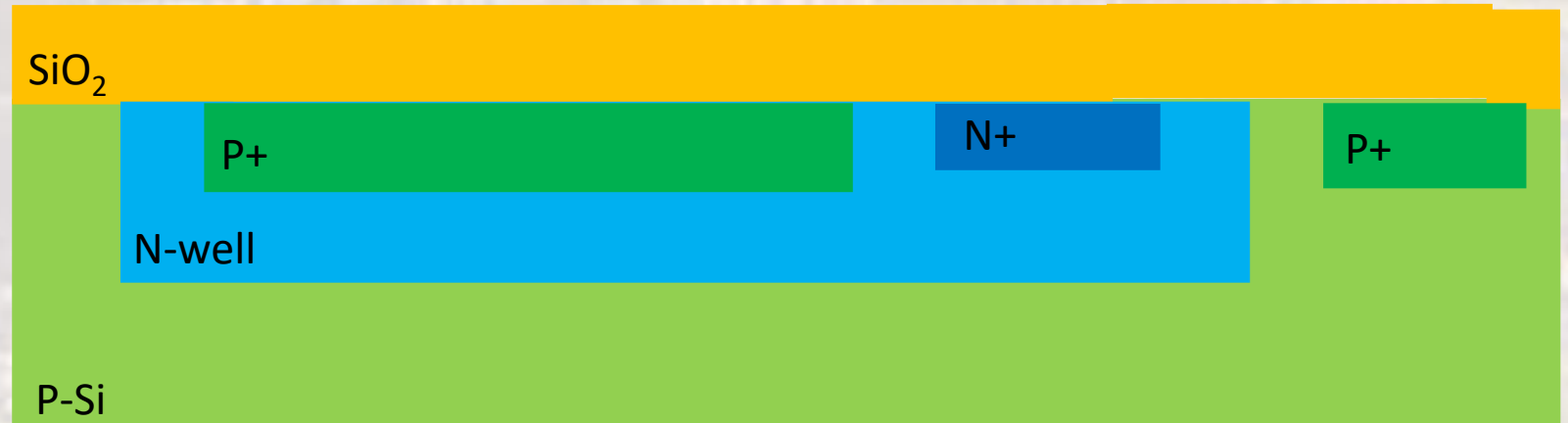


N+ Implant/Diffusion and Drive



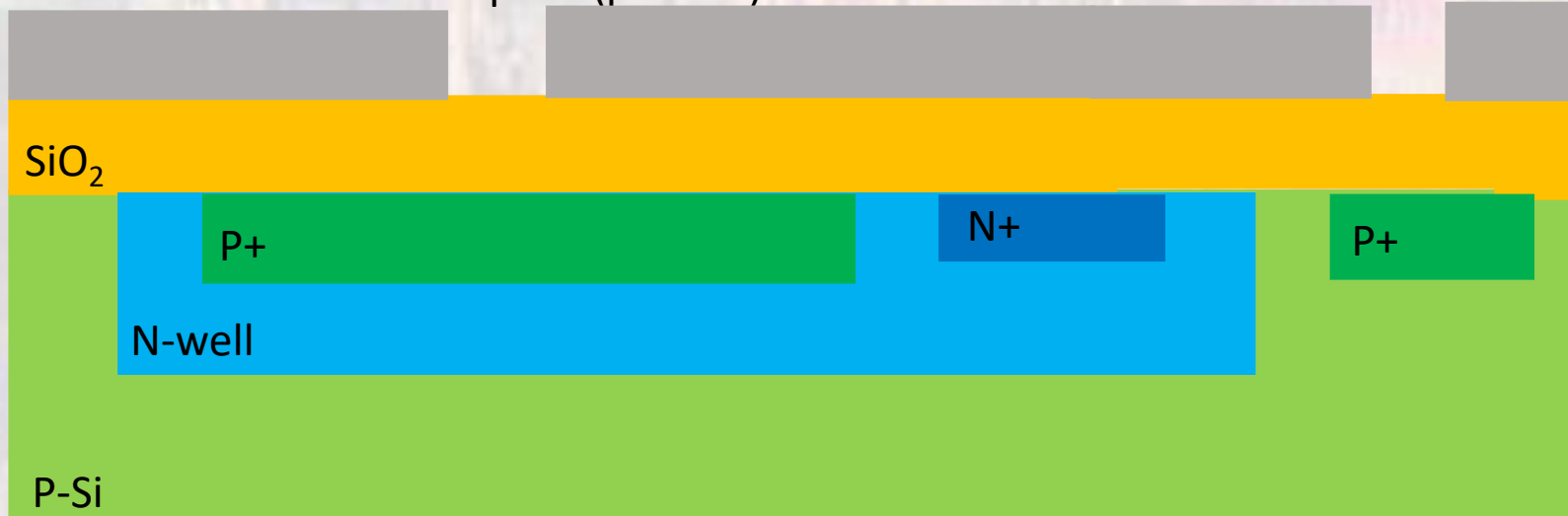
# Diode

Strip(?) and deposit oxide



# Diode

Expose (pattern) and rinse

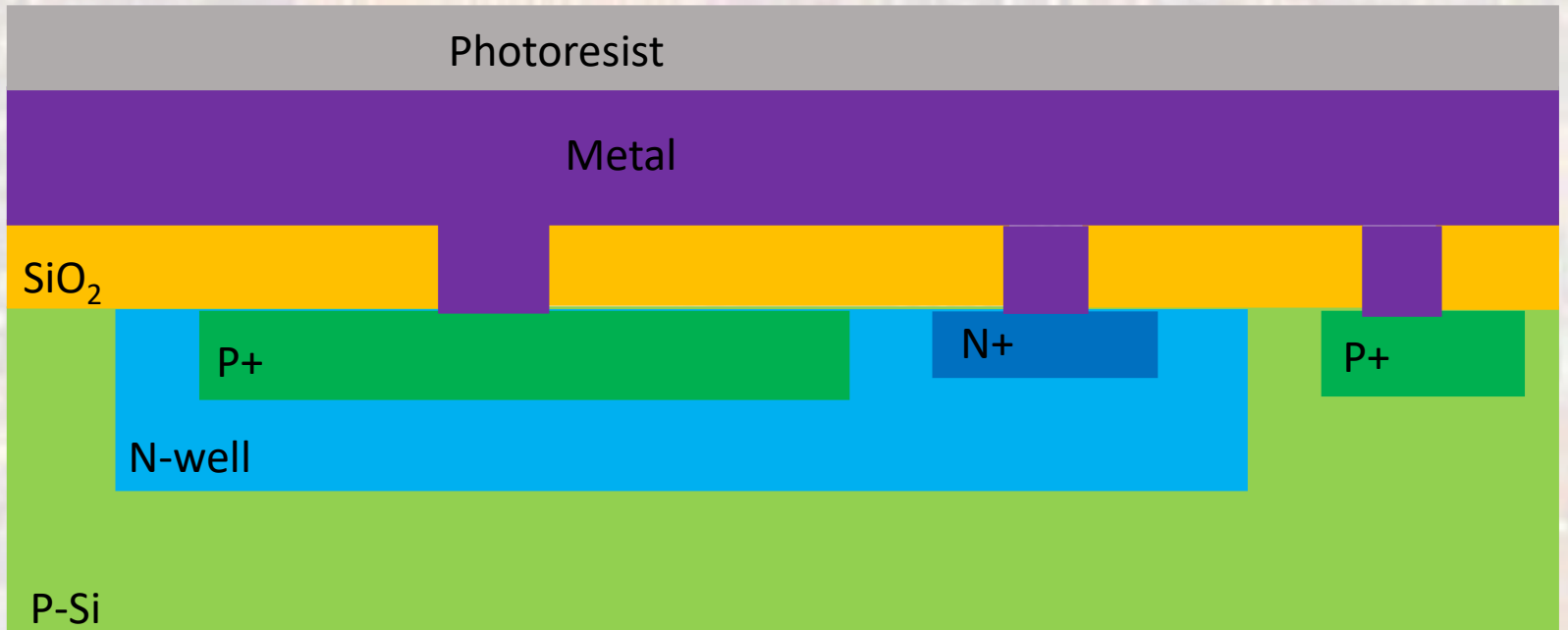
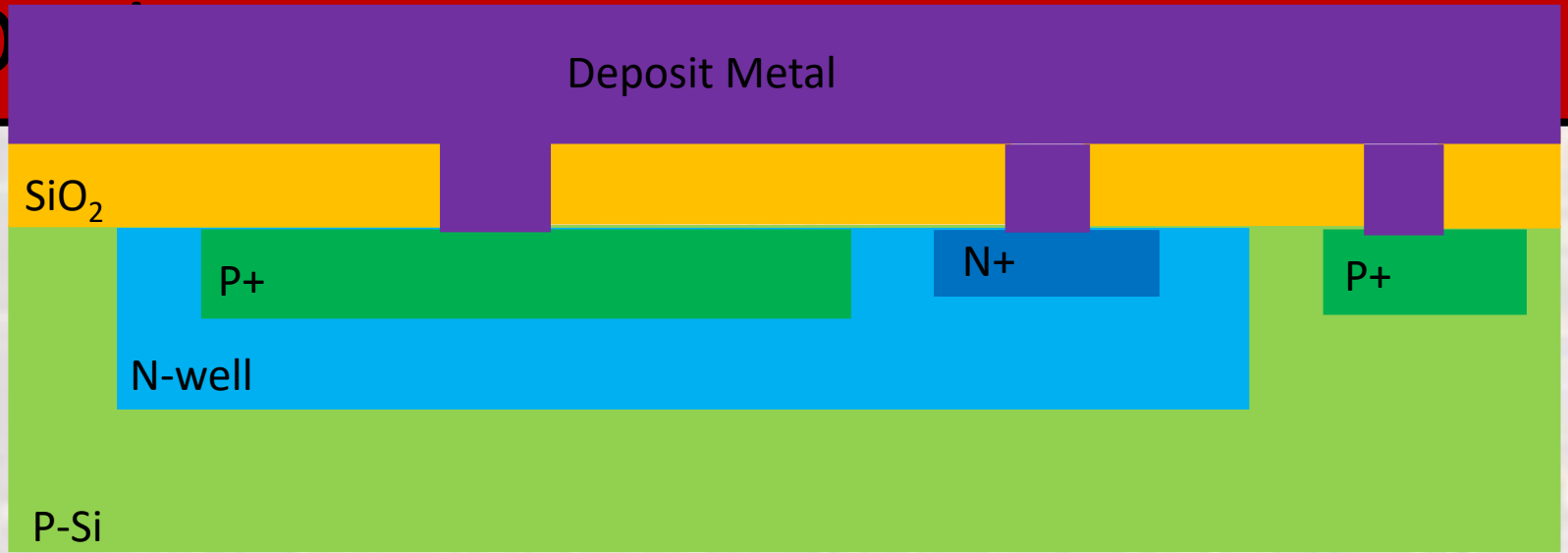


Etch oxide  
Remove Resist



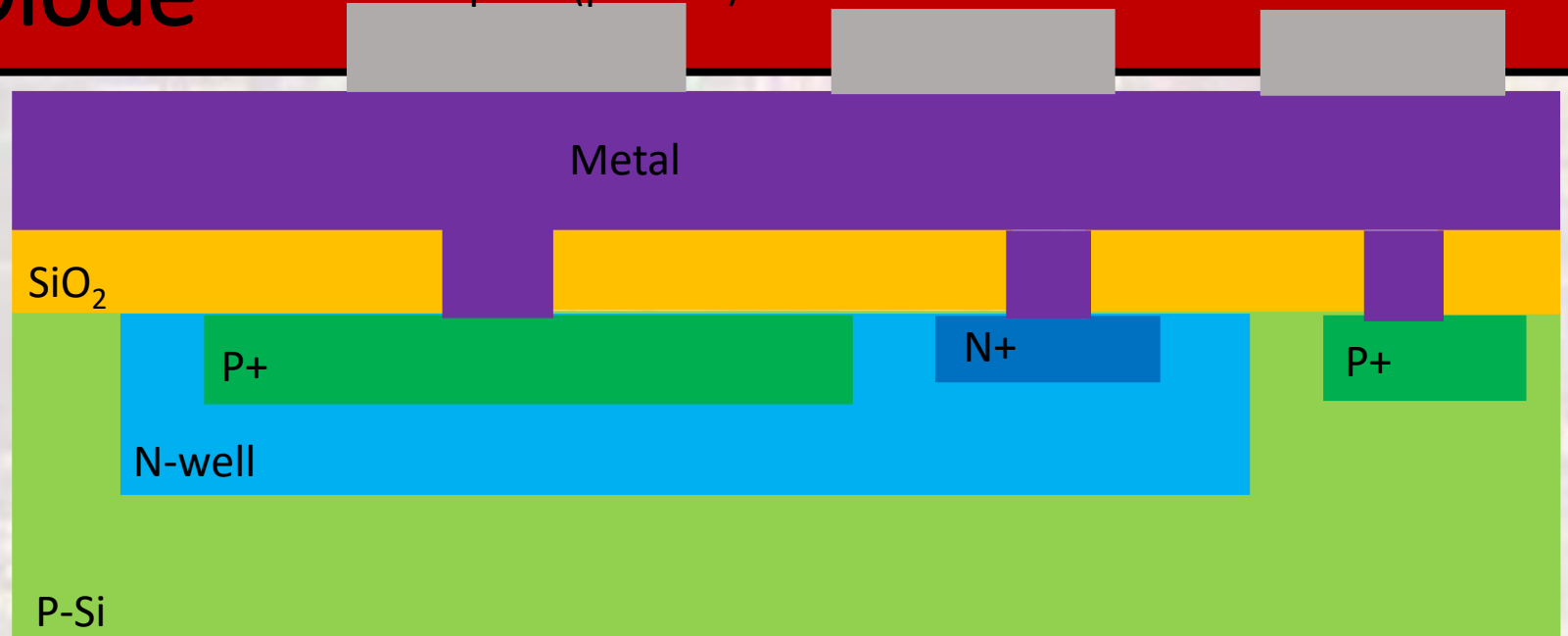


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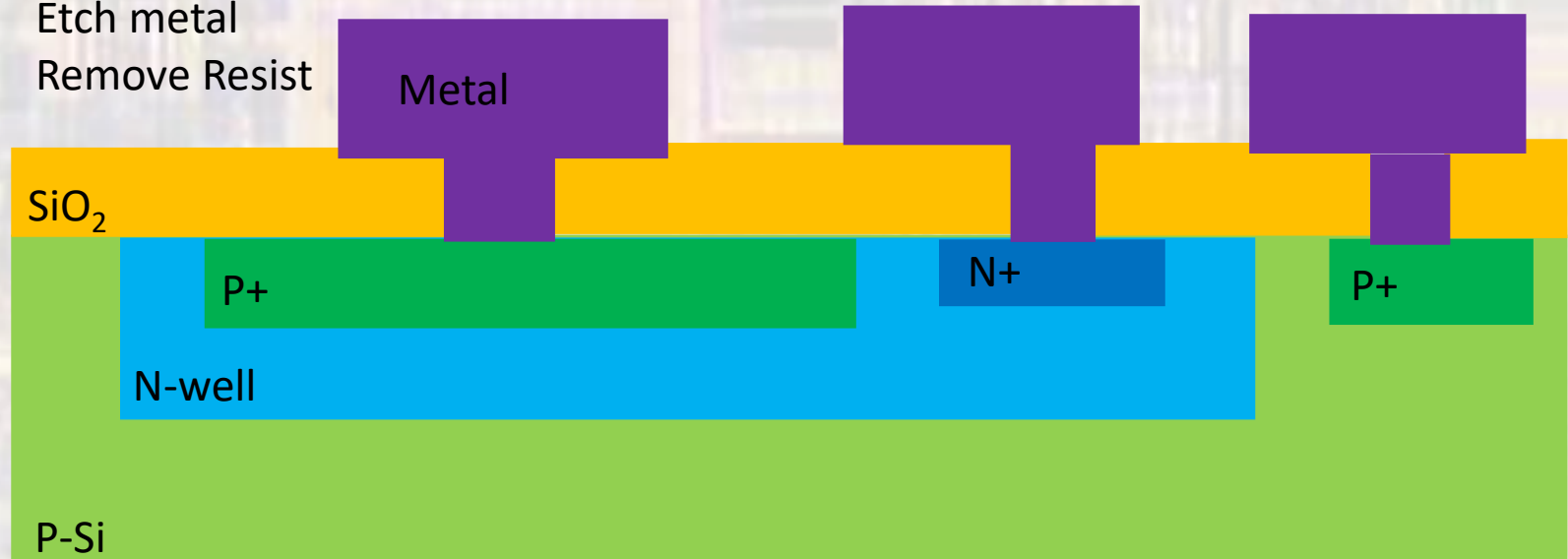


# Diode

Expose (pattern) and rinse

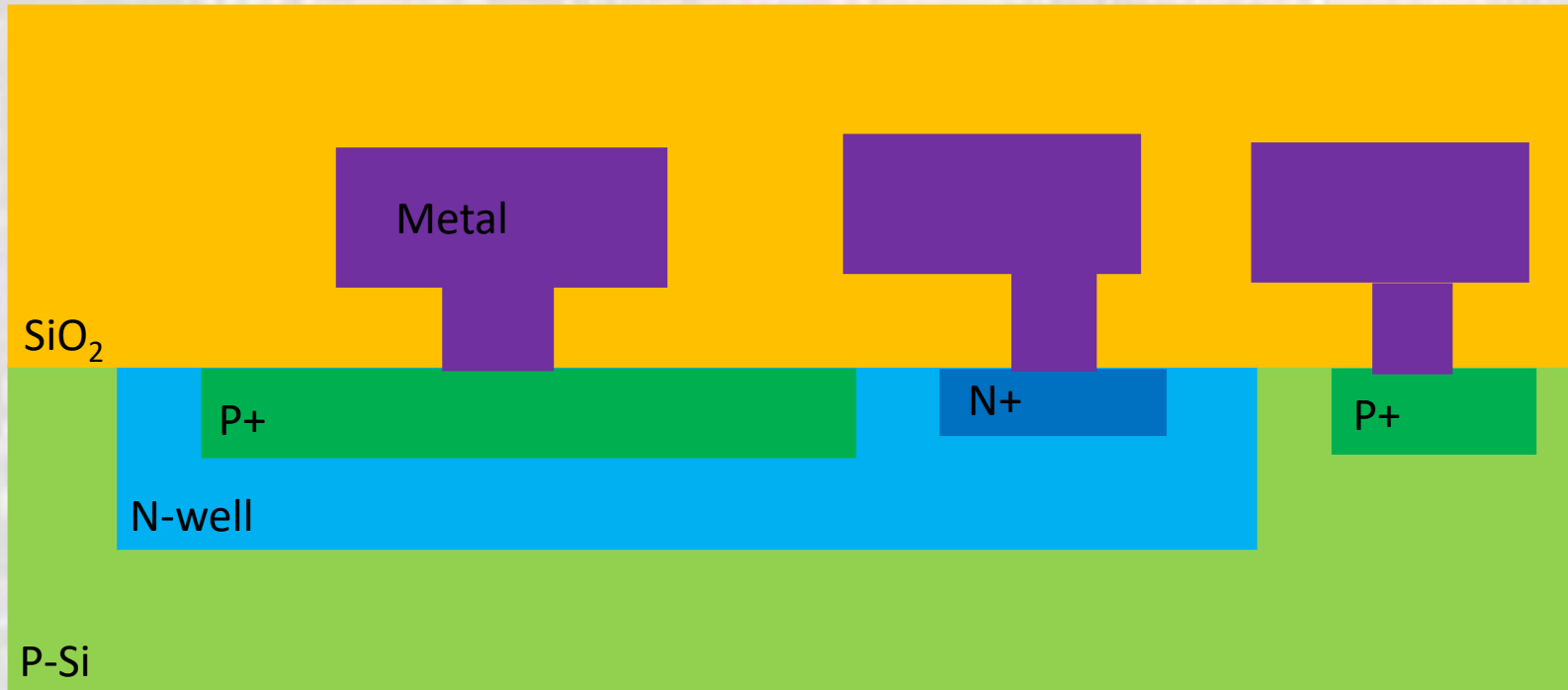


Etch metal  
Remove Resist



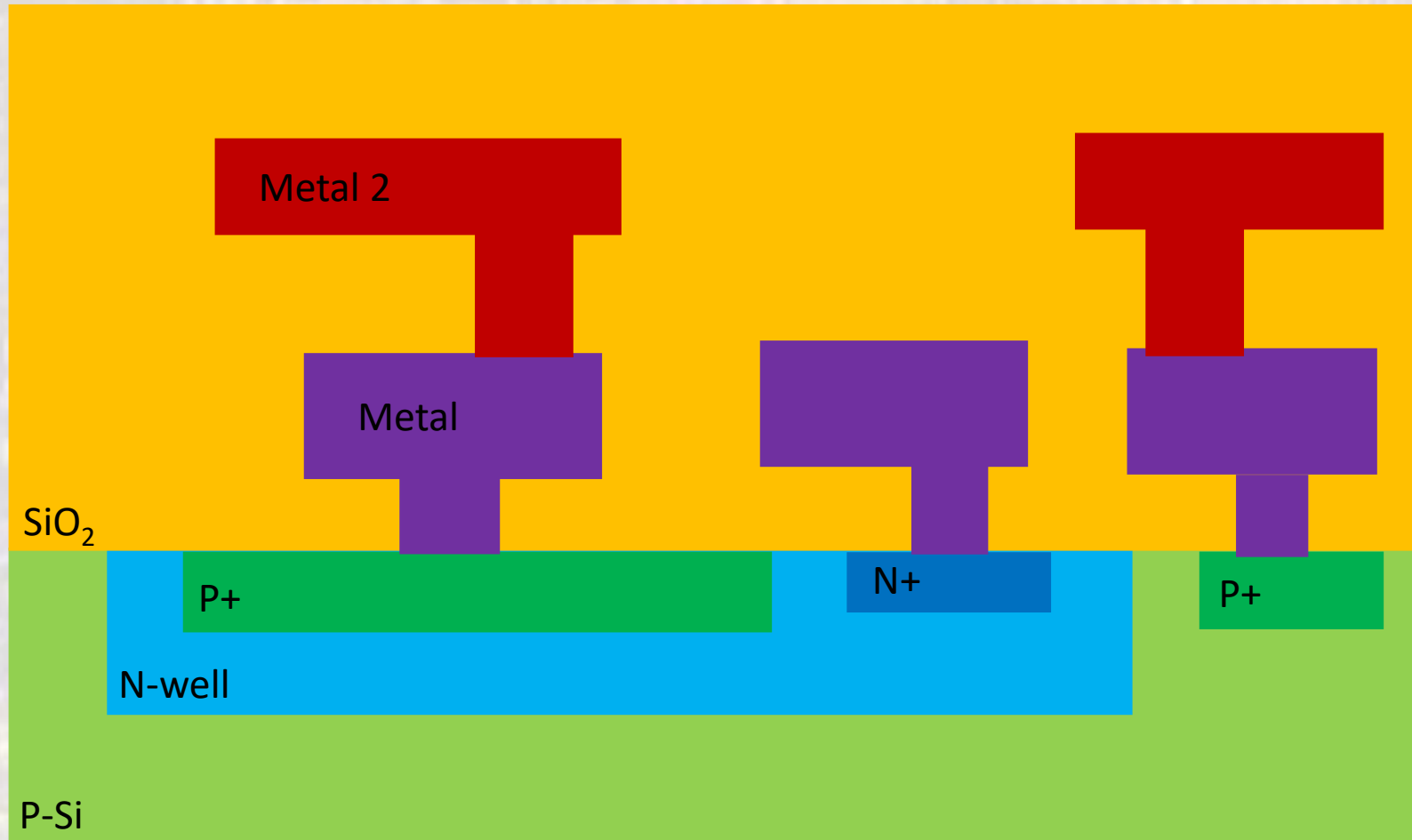
# Diode

Deposit Oxide



# Diode

Resist – Pattern – Rinse – Etch Oxide – Deposit Metal2  
Resist – Pattern – Rinse – Etch Metal2 – Deposit Oxide



# Diode

Resist – Pattern – Rinse – Etch Oxide – Deposit Metal2  
Resist – Pattern – Rinse – Etch Metal2 – Deposit Oxide

