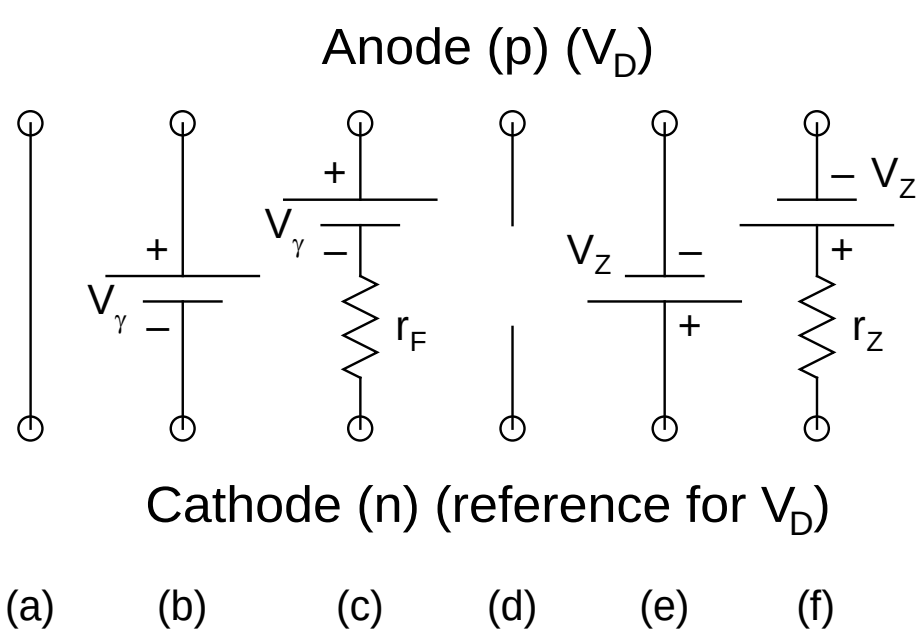
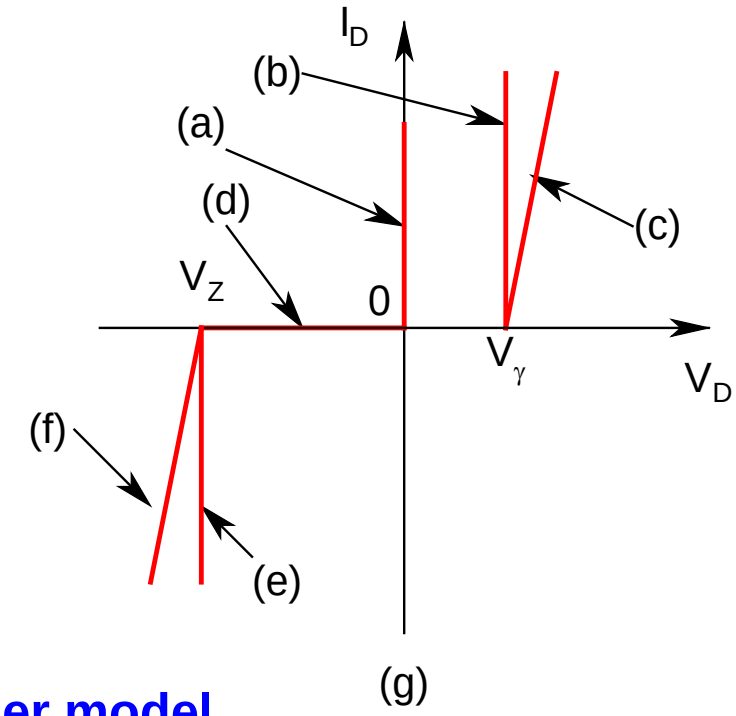
PWL Circuit Models

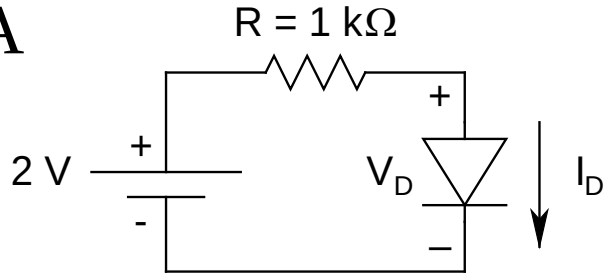




Forward Bias : **V_D positive**: (a) **0^{th} order model**, (b) **1^{st} order model**, (c) **2^{nd} order model**, **Reverse Bias** : **V_D negative**: (d) **0^{th} order model**, **Breakdown** : (e) **1^{st} order model**, (f) **2^{nd} order model** (g) **Corresponding piecewise linear models**

0^{th}-Order Model: **Ideal Diode**

- Ex.: Find I_D and V_D, using: i) 0^{th} order, ii) 1^{st} order, and 2^{nd} order diode models. [V_γ = 0.6 V, $r_F = 50\ \Omega$]



i) ***0th order model***: $I_D = 2/(1\ \text{k}\Omega) = 2\ \text{mA}$

$V_D = 0\ \text{V}$

ii) ***1st order model***:

$I_D = (2-0.6)/(1\ \text{k}\Omega) = 1.4\ \text{mA}$ and $V_D = 0.6\ \text{V}$

iii) ***2nd order model***:

$I_D = (2-0.6)/(1\ \text{k}\Omega + 50\ \Omega) = 1.33\ \text{mA}$

$V_D = V_\gamma + I_D r_F = 0.667\ \text{V}$