Small-Signal Model Parameters

- ***Diode Resistance*** (r_D)/***Diode Conductance*** (g_D):

$$r_D = (g_D)^{-1} = \left(\frac{\partial I_D}{\partial V_D} \right)^{-1} \Bigg|_{I_D = I_{DQ}} = \frac{V_T}{I_{DQ}}$$

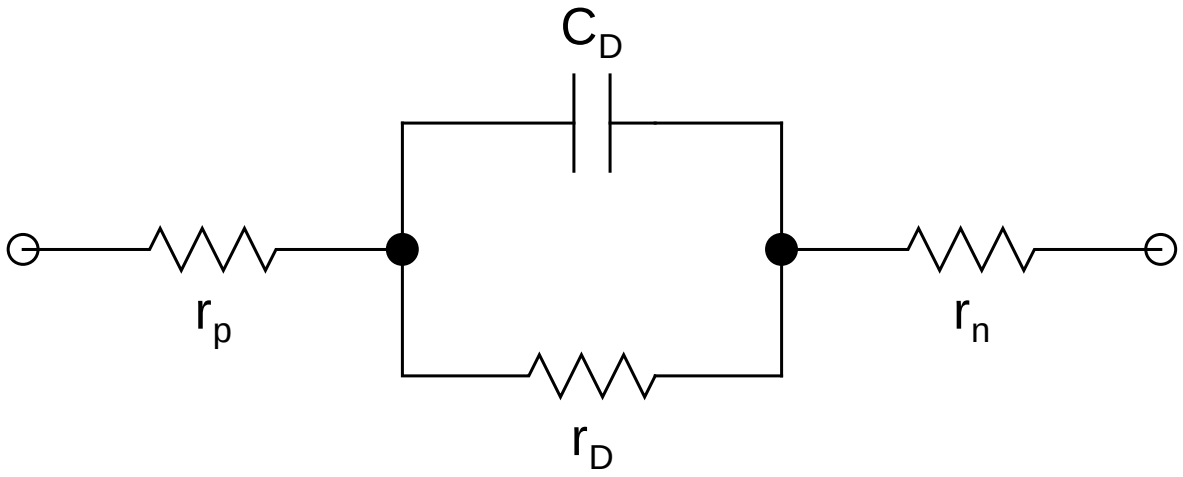
  - For I_{DQ} = 1 mA, r_D = 26 Ω
  - ***Under forward bias***, diode offers ***very small resistance***

- ***Diode Capacitance*** (C_D):
  - $C_D = C_{dep} + C_{diff}$

    $= C_{dep0}/(1 - V_D/V_0)^m + \tau/r_D$
    - m: ***Grading coefficient***

      (1/2 for ***abrupt step junction***, 1/3 for ***linearly graded junction)***
- ***Both r_D and C_D appear in parallel across the junction***
- ***The two quasi-neutral resistance r_p and r_n appear in series with this combination***

Small-Signal Equivalent



- ***In absence of r_p and r_n***, it's just a ***parallel RC circuit***, and ***shorts out*** at ***high frequency***
  - ***Diode time constant*** $\tau_D = r_D C_D = \tau$