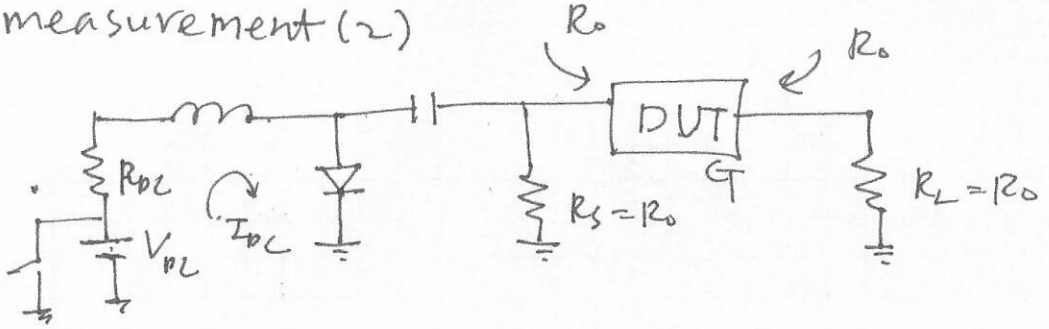
NF measurement (2)



- Step-1) Turn-on switch → $I_{DC} = 0$
  ⇒ output noise power ($= P_{on}$)

$$P_{on} = KT\Delta f \cdot G + P_{on,DUT}$$

($KT\Delta f \cdot G$: noise power from R_S; $P_{on,DUT}$: noise power from DUT)

- Step-2) Turn-off switch and adjust V_{DC} Until output power becomes $2 \cdot P_{on}$

$$\Rightarrow 2P_{on} = \underbrace{2qI_{DC}\Delta f (R_S \| R_o)^2 \cdot G}_{\text{output noise power due to diode noise}} + KT\Delta f G + P_{on,DUT}$$

$$= \frac{1}{2} qI_{DC}\Delta f R_S^2 G + P_{on}$$

$$\therefore P_{on} = \frac{1}{2} qI_{DC}\Delta f R_S^2 G$$

$$\Rightarrow P_{on,DUT} = qI_{DC}\Delta f R_S^2 G - KT\Delta f \cdot G$$

From Step-1) and Step-2),

$$\text{Noise factor, } F = 1 + \frac{P_{on,DUT}}{KT\Delta f \cdot G} = \frac{\frac{1}{2} qI_{DC} R_S^2}{2KT} = \frac{I_{DC}}{2V_T} \cdot R_S^2$$

* Note: In this method, you don't need to know bandwidth of the DUT.