

RUIDO TÉRMICO EN UN CONDUCTOR

POTENCIA DE RUIDO DISPONIBLE:

$$P_n = kTB \quad k: 1,38 \times 10^{-23} \frac{J}{^\circ K}$$

y

$$e_R = \sqrt{4kTRB} \text{ [Vrms]} \quad \text{o} \quad e_R = 0,14\sqrt{R}\sqrt{B} \text{ [nVrms]}$$

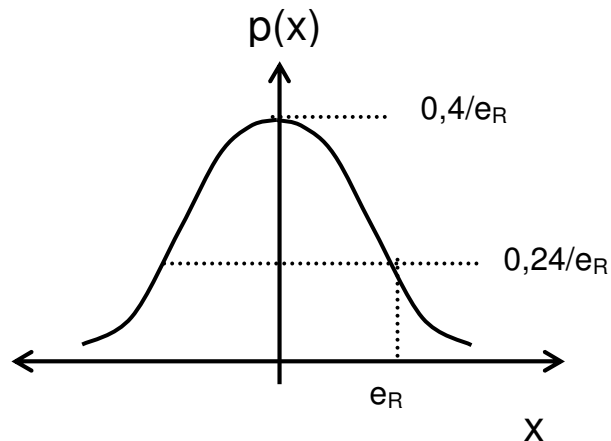
Densidad espectral de potencia:

$$S(T) = \frac{e_R^2}{B} = 4kTR \text{ [} \frac{V^2}{\text{Hz}} \text{]} \quad \text{o} \quad e(T) = \sqrt{S(T)} \text{ [} \frac{V}{\sqrt{\text{Hz}}} \text{]}$$

Distribución de amplitud

$$p(x) = \frac{1}{2\pi\sigma} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

Con $\mu = 0$
y $\sigma = e_R$



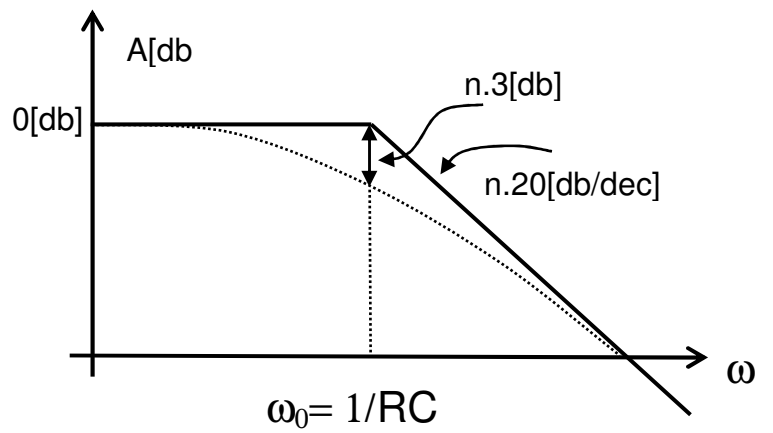
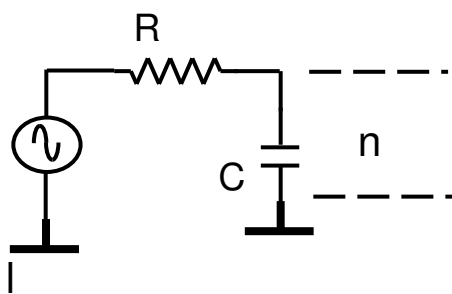
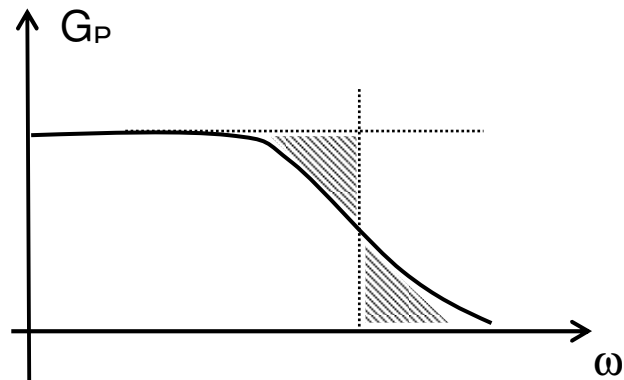
Factor de cresta: $\frac{V^{\wedge}}{V_{rms}}$

Considerando picos que ocurran al menos durante el 0,01% del tiempo de observación resulta

$$\frac{V^{\wedge}}{V_{rms}} = 4$$

ANCHO DE BANDA EQUIVALENTE DE RUIDO.

$$\Delta f = \frac{1}{G_{P_o 0}} \int_0^{\infty} G(f) df$$



n	B/ω_0
1	1,57
2	1,22
3	1,15
4	1,11

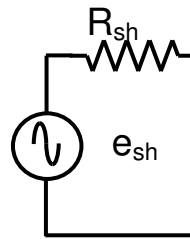
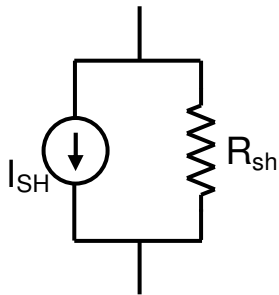
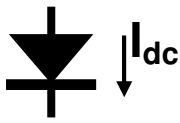
RUIDO SHOT

$$I_{sh} = \sqrt{2qI_{dc}B}$$

$$I_D = I_s (e^{\frac{qV_D}{kT}} - 1)$$

$$\frac{\partial I_D}{\partial V_D} = \frac{1}{r_D}$$

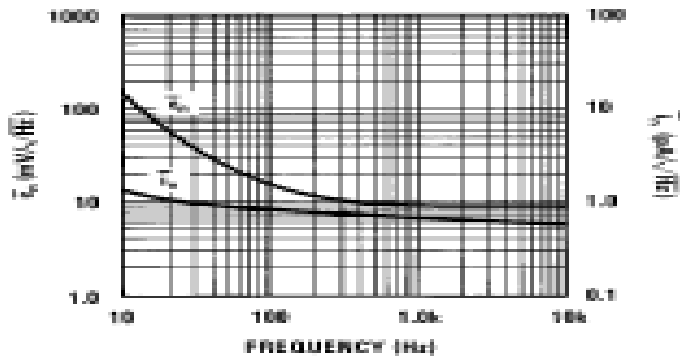
$$R_{sh} = r_D = \frac{V_T}{I_D}$$



RUIDO EN EXCESO:

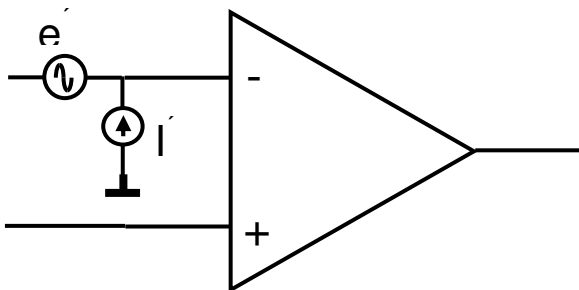
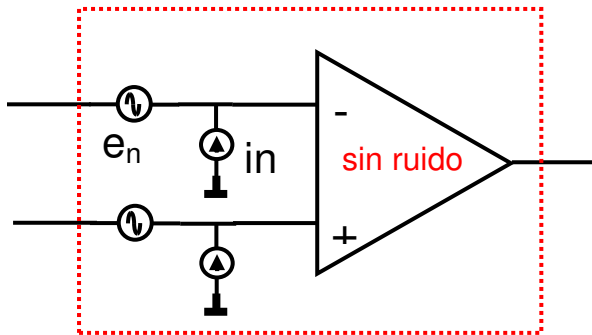
Densidad espectral de potencia

$$\frac{E^2}{f^\alpha}$$



TLVH7314-2

FIGURE 2. Noise Voltage and Current for an Op Amp



$$e'_n = \sqrt{2} e_n$$

$$i'_n = \sqrt{2} i_n$$

FIGURA DE RUIDO

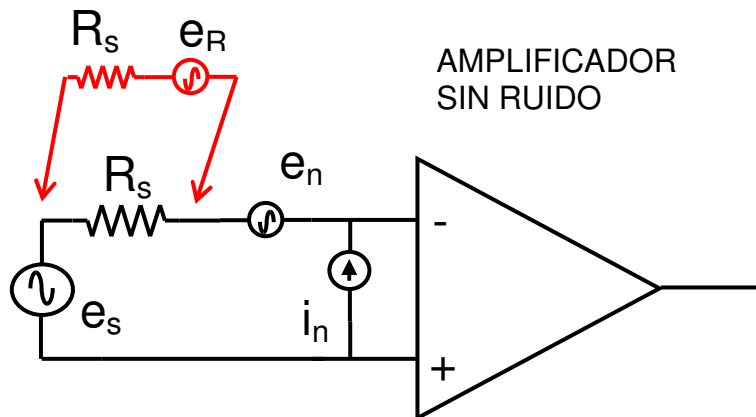


FIGURA DE RUIDO:

ruido a la entrada sin amplificador

Ruido a la salida con señal

$$NF = 10 \bullet \log \left[\frac{(S/N)_{IN}}{(S/N)_{OUT}} \right]$$

$$NF = 10 \bullet \log \left[\frac{S_{IN} G_P N_{IN}}{S_{IN} G_P N_{IN}} \right] = 10 \log \left[\frac{e_N^2 + e_R^2 + (i_N R_s)^2}{e_R^2} \right]$$

RESISTENCIA DE RUIDO:

Genera ruido térmico igual al ruido del amplificador

$$R_n = \frac{E_n^2 + I_n^2 R_s^2}{4kT\Delta f}$$

TEMPERATURA DE RUIDO:

Temperatura para la cual la resistencia del generador tiene un ruido igual al del amplificador.

$$T_s = \frac{E_n^2 + I_n^2 R_s^2}{4kR_s\Delta f}$$

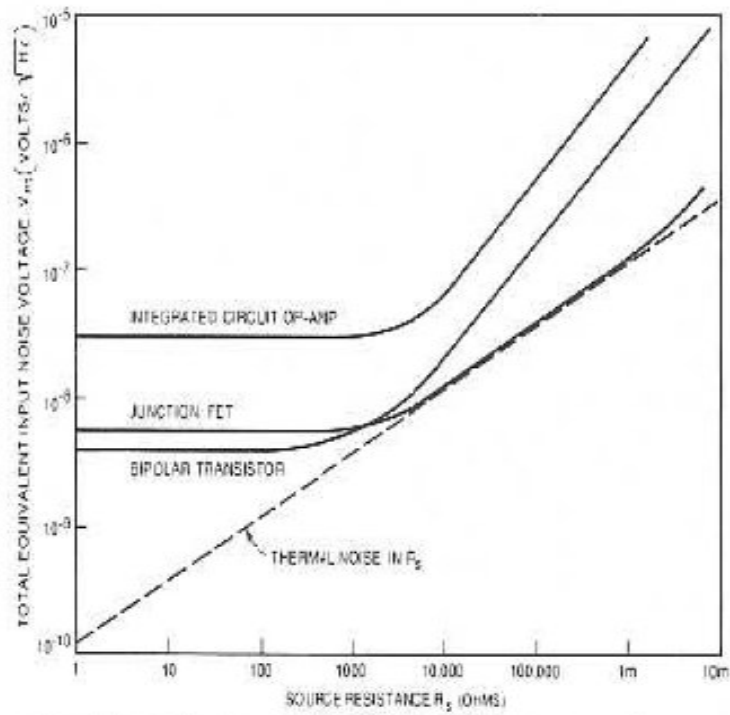


Figure 9-6. Typical total equivalent noise voltage curves for three types of devices.

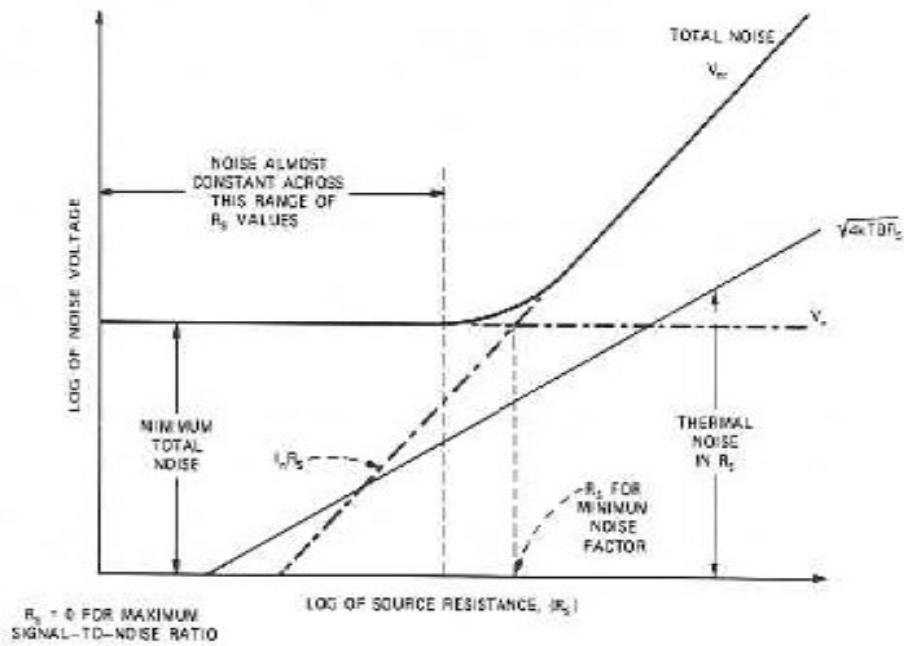
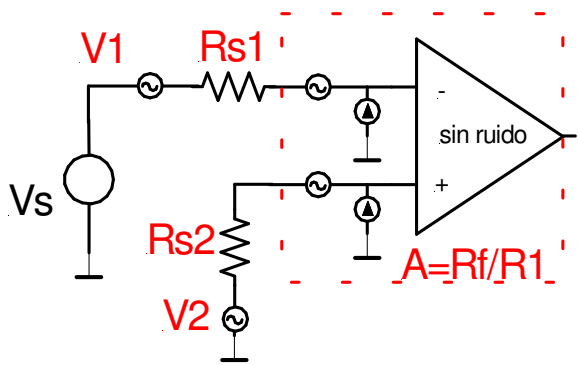
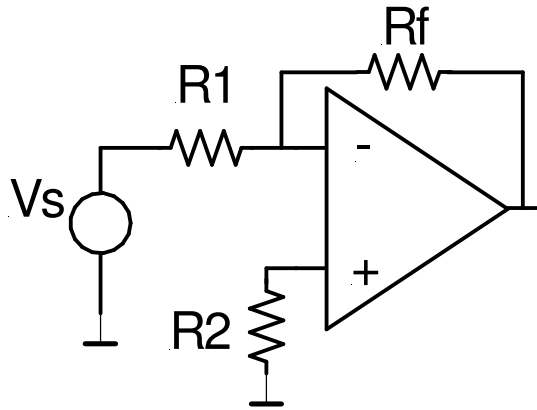


Figure 9-7. Total equivalent input noise voltage V_m for a typical device. The total noise voltage is made up of three components (thermal noise, V_n , and $I_n R_s$) as was shown in Eq. 9-30.

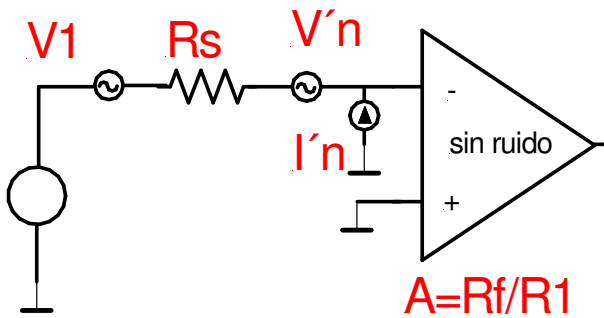
Ejemplo:



$$V_1 = \sqrt{4kTB R_{s1}}$$

$$V_2 = \sqrt{4kTB R_2}$$

$$R_{s1} = \frac{R_1 \cdot R_f}{R_1 + R_f}$$



$$V_n' = \sqrt{V_{n1}^2 + V_{n2}^2}$$

$$I_n' = \sqrt{I_{n1}^2 + I_{n2}^2}$$

$$V_1 = \sqrt{8kTB R_s}$$