Therefore equivalent input noise voltage to create this noise current is

$$\overline{v_{neq}} \cdot \frac{\frac{g_m}{sC_{gs}}}{R_S + R_g + \frac{1}{sC_{gs}} + \left(1 + \frac{g_m}{sC_{gs}}\right) \cdot sL_S} = \overline{i_{no}}\Big|_{\text{due to } \overline{i_{nd}}}$$

$$\Rightarrow \overline{v_{neq}} = \frac{\left(\frac{z_{in2}}{z_{in1} /\!/ sL_S + z_{in2}} \cdot \overline{i_{nd}}\right)}{\left(\frac{\frac{g_m}{sC_{gs}}}{R_S + R_g + \frac{1}{sC_{gs}} + \left(1 + \frac{g_m}{sC_{gs}}\right) \cdot sL_S}\right)}$$

if $|z_{in}| \gg \omega L_S$

$$= \frac{\frac{1 + sC_{gs}R_S}{g_m sL_S + 1 + sC_{gs}R_S}}{\frac{\frac{g_m}{sC_{gs}}}{R_S + \frac{g_m L_S}{C_{gs}} + \frac{1}{sC_{gs}}}} \cdot \overline{i_{nd}}$$

if $\left|1 + j\omega C_{gs} \cdot R_S\right| \gg g_m \cdot \omega L_S$

$$\simeq \frac{1}{g_m}\left(1 + sC_{gs}\left(R_S + \frac{g_m L_S}{C_{gs}}\right)\right) \overline{i_{nd}}$$

$\therefore$ Input referred noise voltage, $\overline{v_{n,in}}$

$$\overline{v_{n,in}} = \overline{v_{ng}} + \overline{v_{neq}}$$

$$\simeq \overline{v_{ng}} + \overline{i_{nd}} \cdot \frac{1}{g_m}\left(1 + sC_{gs}\left(R_S + \frac{g_m L_S}{C_{gs}}\right)\right)$$