1) $THD = HD_3 = \frac{1}{4} \frac{|\alpha_3|}{\alpha_1} V_{peak}^2$

$$= \frac{1}{4} \cdot \frac{1}{8(V_{GS}-V_{th})^2} = \frac{1}{32(V_{GS}-V_{th})^2}$$

2) $S_{out} = (G_m \cdot V_{in})^2 R_L$

$N_{out} = 4KT \frac{\gamma}{\alpha} G_m \times 2 \times R_L$ ~~Because of 2 transistors.~~

← because of two transistor.

$$\left(S/N\right)_{out} = \frac{G_m}{8KT\frac{\gamma}{\alpha}} V_{in}^2$$

3) $W/L \uparrow \times 2 \longrightarrow G_m = \sqrt{2\mu_n C_{ox} \frac{W}{L} I_D} \uparrow \times \sqrt{2}$

$= \mu_n C_{ox} \frac{W}{L}(V_{GS}-V_{th}) \uparrow \times \sqrt{2}$

$\therefore (V_{GS}-V_{th}) \downarrow \frac{1}{\sqrt{2}}$

$\Rightarrow N_{out} \uparrow \times \sqrt{2}$

$\Rightarrow (S/N)_{out} \uparrow \times \sqrt{2}$

$\Rightarrow HD_3 \uparrow \times 2$ ← compare this result with that of single-ended case.

To maintain same bias current.

4) $(V_{GS}-V_{th}) \uparrow \times 2 \longrightarrow W/L \downarrow \times \frac{1}{4}$

$\rightarrow G_m = \mu_n C_{ox} \frac{W}{L}(V_{GS}-V_{th}) \downarrow \frac{1}{2}$

$\Rightarrow N_{out} \downarrow \times \frac{1}{2}$

$\Rightarrow (S/N)_{out} \downarrow \times \frac{1}{2}$

$\Rightarrow HD_3 \downarrow \times \frac{1}{4}$ ← compare this result with that of single-ended case.