

$$\begin{matrix}??\\I_D\\g_m\\??\\??\end{matrix}$$

$$\begin{matrix}??\\I_D\\??\\?\\I_D\\V_G\\I_D\\V_G\\I_D\\I_D\\V_G\end{matrix}$$

$$\begin{matrix}(\textbf{a})\\(\textbf{b})\end{matrix}$$

$$\begin{matrix}??\\V_{out}\end{matrix}$$

$$\begin{matrix}?\\g_m\\??\\v_s\\V_{out}\\v_sg_m\times\\R_{TIA}\end{matrix}$$

$$\begin{matrix}I_DV_G\\I_DV_G\\g_m=\\{\partial I_D\over\partial V_G}\\g_m\\V_{out}\\g_m\\V_G\\I_D\\I_D\\g_m\end{matrix}$$

$$\begin{matrix}??\\??\\R_{NW}\\I_{NW}\end{matrix}$$

$$(\textbf{a})$$

$$\begin{matrix}?\\R_{NW}\end{matrix}$$

$$(\textbf{b})$$

$$\begin{matrix}I_{NW}=\\(V_{Ref}-\\V_{in})/R_{NW}\\{\Delta i\over\Delta v i}/R_{NW}\end{matrix}$$

$$??$$

$$(1) \quad V_{TIA} = V_{Ref} + I_{NW} R_{TIA} + \Delta i R_{TIA}$$

$$\begin{matrix}I_{NW}\\R_{TIA}\\V_{SS}^{Ref}-\\R_{TIA} < I_{NW} < \frac{V_{DD}-V_{Ref}}{R_{TIA}}\end{matrix}$$

$$\begin{matrix}R_{TIA}\\I_{NW}\end{matrix}$$

$$\begin{matrix}??\\??\end{matrix}$$

$$(2) \quad V_{TIA} = V_{Ref} + (I_{NW} - I_{bias}) R_{TIA} + \Delta i R_{TIA}$$

$$I_{NW}$$

$$\begin{matrix}\Delta I\\??\\R_{TIA}\\100k\Omega\end{matrix}$$

$$(\textbf{a})$$

$$(\textbf{b})$$