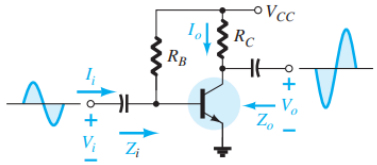
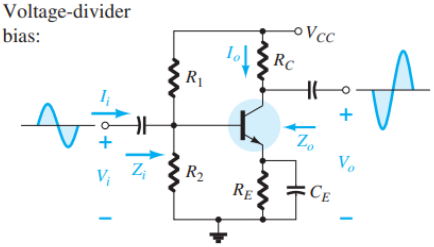
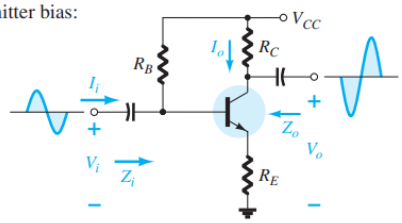
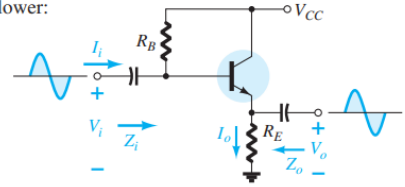
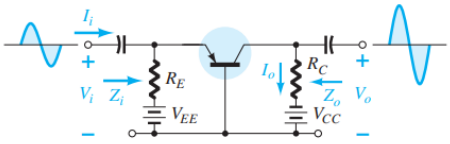
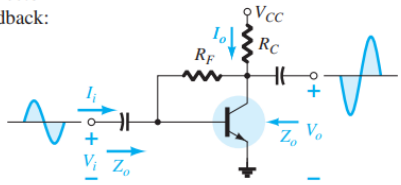
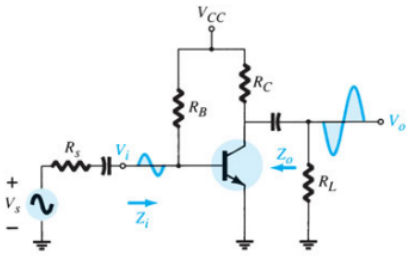
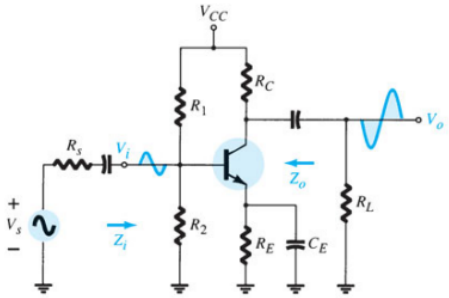
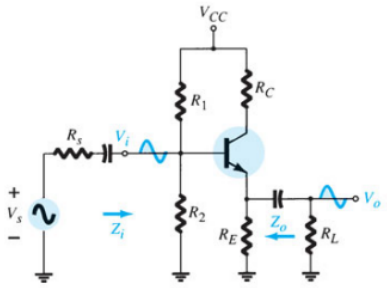
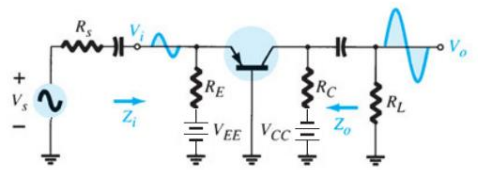
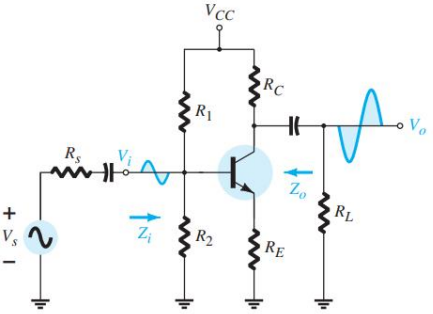
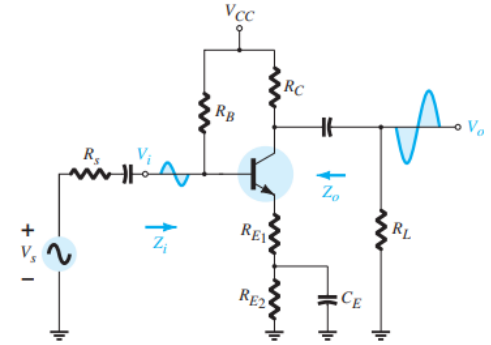
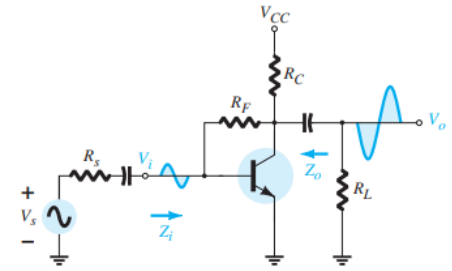
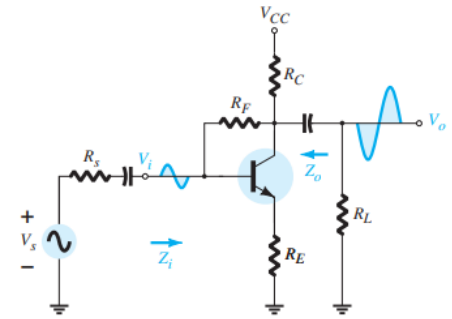
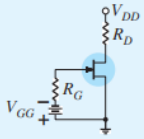
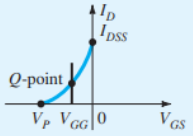
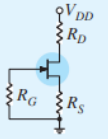
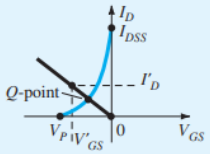
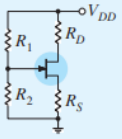
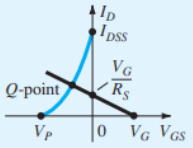
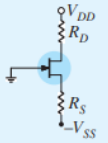
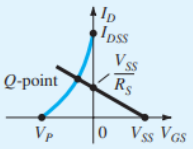
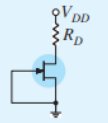
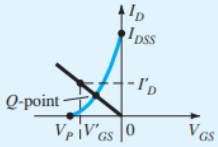
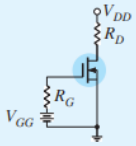
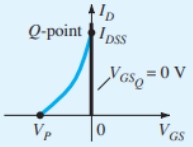
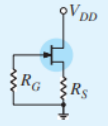
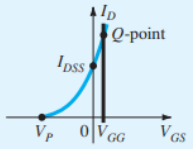
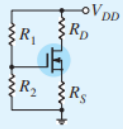
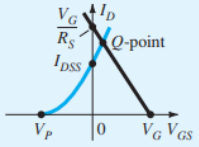
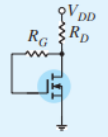
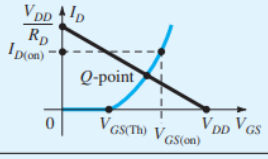
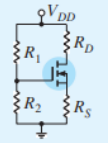
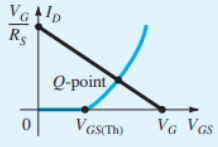
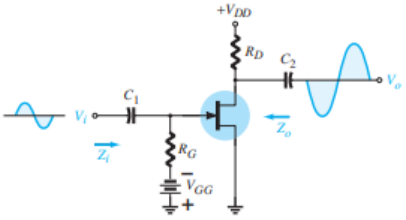
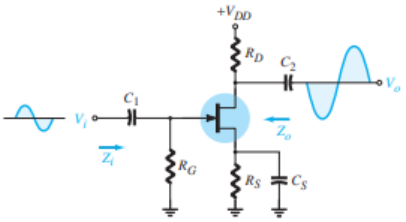
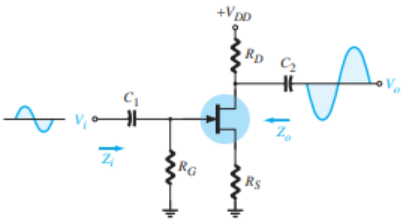
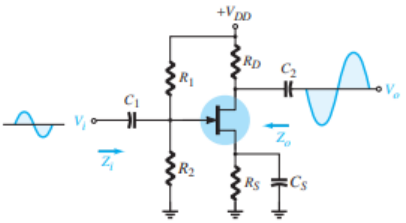
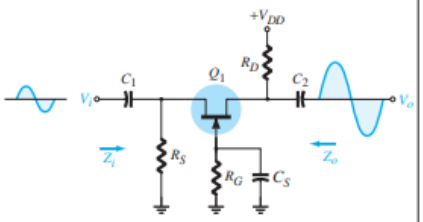
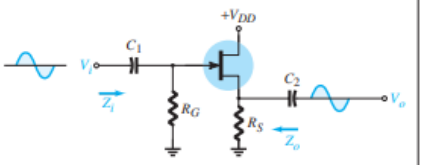
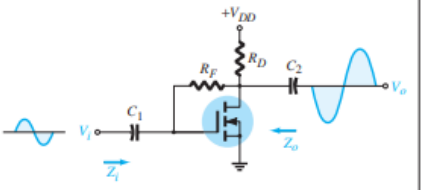
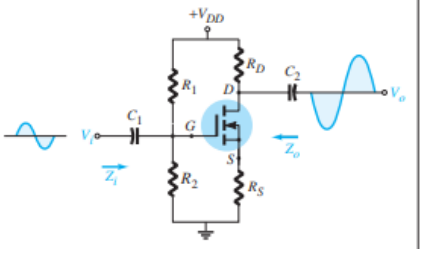
Configuration	Z_i	Z_o	A_v	A_i
Fixed-bias: 	Medium (1 kΩ) $= \boxed{R_B \| \beta r_e}$ $\cong \boxed{\beta r_e}$ $(R_B \geq 10\beta r_e)$	Medium (2 kΩ) $= \boxed{R_C \| r_o}$ $\cong \boxed{R_C}$ $(r_o \geq 10R_C)$	High (−200) $= \boxed{-\frac{(R_C \| r_o)}{r_e}}$ $\cong \boxed{-\frac{R_C}{r_e}}$ $(r_o \geq 10R_C)$	High (100) $= \boxed{\frac{\beta R_B r_o}{(r_o + R_C)(R_B + \beta r_e)}}$ $\cong \boxed{\beta}$ $(r_o \geq 10R_C,$ $R_B \geq 10\beta r_e)$
Voltage-divider bias: 	Medium (1 kΩ) $= \boxed{R_1 \| R_2 \| \beta r_e}$	Medium (2 kΩ) $= \boxed{R_C \| r_o}$ $\cong \boxed{R_C}$ $(r_o \geq 10R_C)$	High (−200) $= \boxed{-\frac{R_C \| r_o}{r_e}}$ $\cong \boxed{-\frac{R_C}{r_e}}$ $(r_o \geq 10R_C)$	High (50) $= \boxed{\frac{\beta(R_1 \| R_2) r_o}{(r_o + R_C)(R_1 \| R_2 + \beta r_e)}}$ $\cong \boxed{\frac{\beta(R_1 \| R_2)}{R_1 \| R_2 + \beta r_e}}$ $(r_o \geq 10R_C)$
Unbypassed emitter bias: 	High (100 kΩ) $= \boxed{R_B \| Z_b}$ $Z_b \cong \beta(r_e + R_E)$ $\cong \boxed{R_B \| \beta R_E}$ $(R_E \gg r_e)$	Medium (2 kΩ) $= \boxed{R_C}$ (any level of r_o)	Low (−5) $= \boxed{-\frac{R_C}{r_e + R_E}}$ $\cong \boxed{-\frac{R_C}{R_E}}$ $(R_E \gg r_e)$	High (50) $\cong \boxed{-\frac{\beta R_B}{R_B + Z_b}}$
Emitter-follower: 	High (100 kΩ) $= \boxed{R_B \| Z_b}$ $Z_b \cong \beta(r_e + R_E)$ $\cong \boxed{R_B \| \beta R_E}$ $(R_E \gg r_e)$	Low (20 Ω) $= \boxed{R_E \| r_e}$ $\cong \boxed{r_e}$ $(R_E \gg r_e)$	Low ($\cong$1) $= \boxed{\frac{R_E}{R_E + r_e}}$ $\cong \boxed{1}$	High (−50) $\cong \boxed{-\frac{\beta R_B}{R_B + Z_b}}$
Common-base: 	Low (20 Ω) $= \boxed{R_E \| r_e}$ $\cong \boxed{r_e}$ $(R_E \gg r_e)$	Medium (2 kΩ) $= \boxed{R_C}$	High (200) $\cong \boxed{\frac{R_C}{r_e}}$	Low (−1) $\cong \boxed{-1}$
Collector feedback: 	Medium (1 kΩ) $= \boxed{\frac{r_e}{\frac{1}{\beta} + \frac{R_C}{R_F}}}$ $(r_o \geq 10R_C)$	Medium (2 kΩ) $\cong \boxed{R_C \| R_F}$ $(r_o \geq 10R_C)$	High (−200) $\cong \boxed{-\frac{R_C}{r_e}}$ $(r_o \geq 10R_C)$ $(R_F \gg R_C)$	High (50) $= \boxed{\frac{\beta R_F}{R_F + \beta R_C}}$ $\cong \boxed{\frac{R_F}{R_C}}$

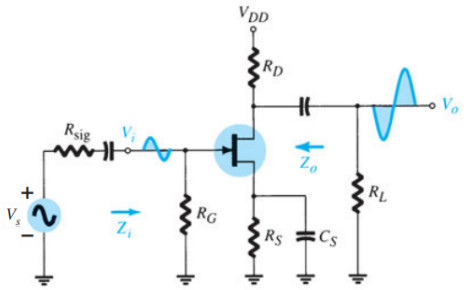
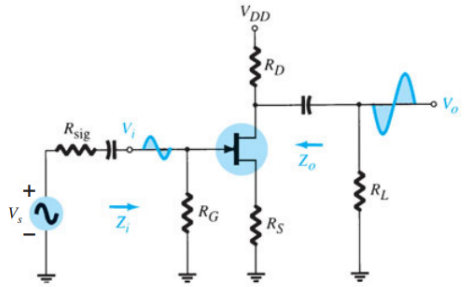
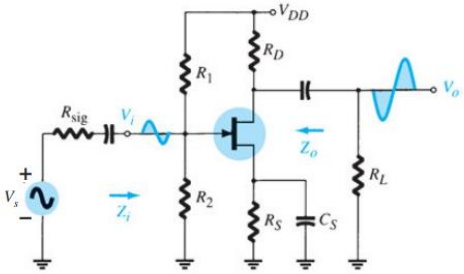
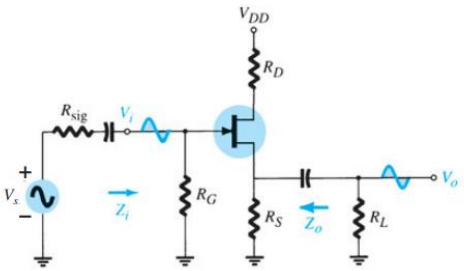
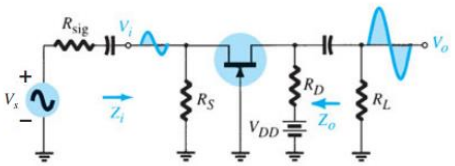
Configuration	$A_{v_L} = V_o/V_i$	Z_i	Z_o
	$\dfrac{-(R_L \| R_C)}{r_e}$	$R_B \| \beta r_e$	R_C
	Including r_o: $\dfrac{-(R_L \| R_C \| r_o)}{r_e}$	$R_B \| \beta r_e$	$R_C \| r_o$
	$\dfrac{-(R_L \| R_C)}{r_e}$	$R_1 \| R_2 \| \beta r_e$	R_C
	Including r_o: $\dfrac{-(R_L \| R_C \| r_o)}{r_e}$	$R_1 \| R_2 \| \beta r_e$	$R_C \| r_o$
	$\cong 1$	$R'_E = R_L \| R_E$ $R_1 \| R_2 \| \beta(r_e + R'_E)$	$R'_s = R_s \| R_1 \| R_2$ $R_E \| \left(\dfrac{R'_s}{\beta} + r_e\right)$
	Including r_o: $\cong 1$	$R_1 \| R_2 \| \beta(r_e + R'_E)$	$R_E \| \left(\dfrac{R'_s}{\beta} + r_e\right)$
	$\cong \dfrac{-(R_L \| R_C)}{r_e}$	$R_E \| r_e$	R_C
	Including r_o: $\cong \dfrac{-(R_L \| R_C \| r_o)}{r_e}$	$R_E \| r_e$	$R_C \| r_o$
	$\dfrac{-(R_L \| R_C)}{R_E}$	$R_1 \| R_2 \| \beta(r_e + R_E)$	R_C
	Including r_o: $\dfrac{-(R_L \| R_C)}{R_E}$	$R_1 \| R_2 \| \beta(r_e + R_e)$	$\cong R_C$

Configuration	$A_{v_L} = V_o/V_i$	Z_i	Z_o
	$\dfrac{-(R_L \| R_C)}{R_{E_1}}$	$R_B \| \beta(r_e + R_{E_1})$	R_C
	Including r_o: $\dfrac{-(R_L \| R_C)}{R_{E_1}}$	$R_B \| \beta(r_e + R_E)$	$\cong R_C$
	$\dfrac{-(R_L \| R_C)}{r_e}$	$\beta r_e \| \dfrac{R_F}{\lvert A_v \rvert}$	R_C
	Including r_o: $\dfrac{-(R_L \| R_C \| r_o)}{r_e}$	$\beta r_e \| \dfrac{R_F}{\lvert A_v \rvert}$	$R_C \| R_F \| r_o$
	$\dfrac{-(R_L \| R_C)}{R_E}$	$\beta R_E \| \dfrac{R_F}{\lvert A_v \rvert}$	$\cong R_C \| R_F$
	Including r_o: $\cong \dfrac{-(R_L \| R_C)}{R_E}$	$\cong \beta R_E \| \dfrac{R_F}{\lvert A_v \rvert}$	$\cong R_C \| R_F$

Type	Configuration	Pertinent Equations	Graphical Solution
JFET Fixed-bias		$V_{GS_Q} = -V_{GG}$ $V_{DS} = V_{DD} - I_D R_S$	
JFET Self-bias		$V_{GS} = -I_D R_S$ $V_{DS} = V_{DD} - I_D(R_D + R_S)$	
JFET Voltage-divider bias		$V_G = \frac{R_2 V_{DD}}{R_1 + R_2}$ $V_{GS} = V_G - I_D R_S$ $V_{DS} = V_{DD} - I_D(R_D + R_S)$	
JFET Common-gate		$V_{GS} = V_{SS} - I_D R_S$ $V_{DS} = V_{DD} + V_{SS} - I_D(R_D + R_S)$	
JFET ($R_D = 0\ \Omega$)		$V_{GS} = -I_D R_S$ $V_D = V_{DD}$ $V_S = I_D R_S$ $V_{DS} = V_{DD} - I_S R_S$	
JFET Special case ($V_{GS_Q} = 0$ V)		$V_{GS_Q} = 0$ V $I_{D_Q} = I_{DSS}$	
Depletion-type MOSFET Fixed-bias (and MESFETs)		$V_{GS_Q} = +V_{GG}$ $V_{DS} = V_{DD} - I_D R_S$	
Depletion-type MOSFET Voltage-divider bias (and MESFETs)		$V_G = \frac{R_2 V_{DD}}{R_1 + R_2}$ $V_{GS} = V_G - I_S R_S$ $V_{DS} = V_{DD} - I_D(R_D + R_S)$	
Enhancement type MOSFET Feedback configuration (and MESFETs)		$V_{GS} = V_{DS}$ $V_{GS} = V_{DD} - I_D R_D$	
Enhancement type MOSFET Voltage-divider bias (and MESFETs)		$V_G = \frac{R_2 V_{DD}}{R_1 + R_2}$ $V_{GS} = V_G - I_D R_S$	

Configuration	Z_i	Z_o	$A_v = \frac{V_o}{V_i}$
Fixed-bias [JFET or D-MOSFET] 	High (10 MΩ) $= R_G$	Medium (2 kΩ) $= R_D \| r_d$ $\cong R_D$ $(r_d \geq 10R_D)$	Medium (−10) $= -g_m(r_d \| R_D)$ $\cong -g_m R_D$ $(r_d \geq 10R_D)$
Self-bias bypassed R_S [JFET or D-MOSFET] 	High (10 MΩ) $= R_G$	Medium (2 kΩ) $= R_D \| r_d$ $\cong R_D$ $(r_d \geq 10R_D)$	Medium (−10) $= -g_m(r_d \| R_D)$ $\cong -g_m R_D$ $(r_d \geq 10R_D)$
Self-bias unbypassed R_S [JFET or D-MOSFET] 	High (10 MΩ) $= R_G$	$= \frac{\left[1 + g_m R_S + \frac{R_S}{r_d}\right] R_D}{\left[1 + g_m R_S + \frac{R_S}{r_d} + \frac{R_D}{r_d}\right]}$ $= R_D$ $r_d \geq 10R_D$ or $r_d = \infty\ \Omega$	Low (−2) $= \frac{g_m R_D}{1 + g_m R_S + \frac{R_D + R_S}{r_d}}$ $\cong -\frac{g_m R_D}{1 + g_m R_S}$ $[r_d \geq 10(R_D + R_S)]$
Voltage-divider bias [JFET or D-MOSFET] 	High (10 MΩ) $= R_1 \| R_2$	Medium (2 kΩ) $= R_D \| r_d$ $\cong R_D$ $(r_d \geq 10R_D)$	Medium (−10) $= -g_m(r_d \| R_D)$ $\cong -g_m R_D$ $(r_d \geq 10R_D)$

Configuration	Z_i	Z_o	$A_v = \frac{V_o}{V_i}$
Common-gate [JFET or D-MOSFET] 	Low (1 kΩ) $= R_S \Vert \left[\frac{r_d + R_D}{1 + g_m r_d} \right]$ $\cong R_S \Vert \frac{1}{g_m}$ $(r_d \geq 10\, R_S)$	Medium (2 kΩ) $= R_D \Vert r_d$ $\cong R_D$ $(R_d \geq 10\, R_D)$	Medium (+10) $= \frac{g_m R_D + \frac{R_D}{r_d}}{1 + \frac{R_D}{r_d}}$ $\cong g_m R_D$ $(r_d \geq 10\, RD)$
Source-follower [JFET or D-MOSFET] 	High (10 MΩ) $= R_G$	Low (100 kΩ) $= r_d \Vert R_S \Vert 1/g_m$ $\cong R_S \Vert 1/g_m$ $(r_d \geq 10\, R_S)$	Low (<1) $= \frac{g_m (r_d \Vert R_S)}{1 + g_m (r_d \Vert R_S)}$ $\cong \frac{g_m R_S}{1 + g_m R_S}$ $(r_d \geq 10\, R_S)$
Drain-feedback bias E-MOSFET 	Medium (1 MΩ) $= \frac{R_F + r_d \Vert R_D}{1 + g_m (r_d \Vert R_D)}$ $\cong \frac{R_F}{1 + g_m R_D}$ $(r_d \geq 10\, R_D)$	Medium (2 kΩ) $= R_F \Vert r_d \Vert R_D$ $\cong R_D$ $(R_F, r_d \geq 10 R_D)$	Medium (−10) $= -g_m (R_F \Vert r_d \Vert R_D)$ $\cong -g_m R_D$ $(R_F, r_d \geq 10 R_D)$
Voltage-divider bias E-MOSFET 	Medium (1 MΩ) $= R_1 \Vert R_2$	Medium (2 kΩ) $= R_D \Vert r_d$ $\cong R_D$ $(r_d \geq 10\, R_D)$	Medium (−10) $= -g_m (r_d \Vert R_D)$ $\cong -g_m R_D$ $(r_d \geq 10\, R_D)$

Configuration	$A_{v_L} = V_o \| V_i$	Z_i	Z_o
	$-g_m(R_D \| R_L)$ Including r_d: $-g_m(R_D \| R_L \| r_d)$	R_G R_G	R_D $R_D \| r_d$
	$\dfrac{-g_m(R_D \| R_L)}{1 + g_m R_S}$ Including r_d: $\dfrac{-g_m(R_D \| R_L)}{1 + g_m R_S + \dfrac{R_D + R_S}{r_d}}$	R_G R_G	$\dfrac{R_D}{1 + g_m R_S}$ $\cong \dfrac{R_D}{1 + g_m R_S}$
	$-g_m(R_D \| R_L)$ Including r_d: $-g_m(R_D \| R_L \| r_d)$	$R_1 \| R_2$ $R_1 \| R_2$	R_D $R_D \| r_d$;
	$\dfrac{g_m(R_S \| R_L)}{1 + g_m(R_S \| R_L)}$ Including r_d: $= \dfrac{g_m r_d(R_S \| R_L)}{r_d + R_D + g_m r_d(R_S \| R_L)}$	R_G R_G	$R_S \| 1/g_m$ $\dfrac{R_S}{1 + \dfrac{g_m r_d R_S}{r_d + R_D}}$
	$g_m(R_D \| R_L)$ Including r_d: $\cong g_m(R_D \| R_L)$	$\dfrac{R_S}{1 + g_m R_S}$ $Z_i = \dfrac{R_S}{1 + \dfrac{g_m r_d R_S}{r_d + R_D \| R_L}}$	R_D $R_D \| r_d$