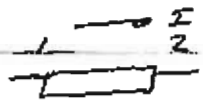
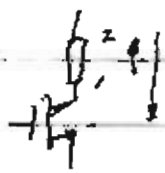
CAD #3

calc $2.5mA = I_D$

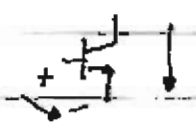


R, L, C



BJT as switch

MOSFET BJTS

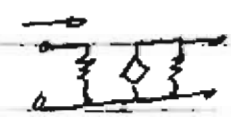


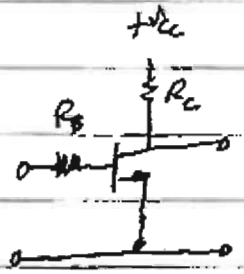
input V_{GS} output I_D

$I = 0$

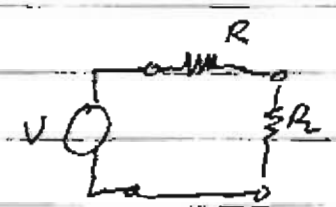
input I_B output I_C

V_{BE} = Constant





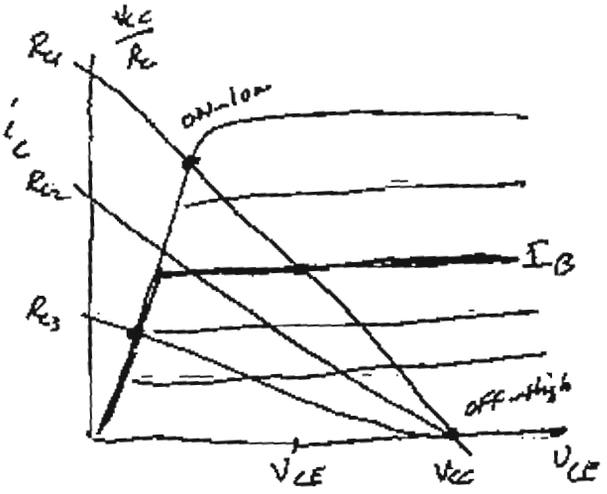
Current limiting resistor



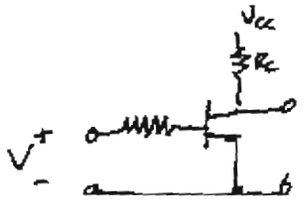
$I_L = \frac{V}{R + R_L}$

Choose R properly

$I_L \approx \frac{V}{R}$



slope $= -\frac{1}{R_c}$



Change R_c

$R_{c1} < R_{c2} < R_{c3}$

$I_B = \frac{V - V_{BE}}{R}$

$I_C = \frac{\beta(V - V_{BE})}{R}$

$V_{CE} \simeq 0$, $V_{CE} \simeq 0.2$

$V_{CE}(sat) = 0.2V$

$$V_{cc} = I_c(sat) R_c + V_{CE}(sat)$$

$$R_c = \frac{V_{cc} - V_{CE}(sat)}{I_c(sat)}$$

R.O.T. $\beta_{dc}(sat) = 10$

Example: $I_c(sat) = 10\,mA$ $V_{cc} = 5$

$\beta(sat) = 10$

$I_B(sat) = 1\,mA$

$$R_B = \frac{V_{cc} - V_{BE}}{I_B(sat)} = \frac{5 - 0.7}{10^{-3}} = 4.3K$$

$$R_c = \frac{V_{cc} - V_{CE}(sat)}{I_c(sat)} = \frac{5 - 0.2}{10^{-2}} = 430\Omega$$

Operation

$V_{IN} = 0, 5$

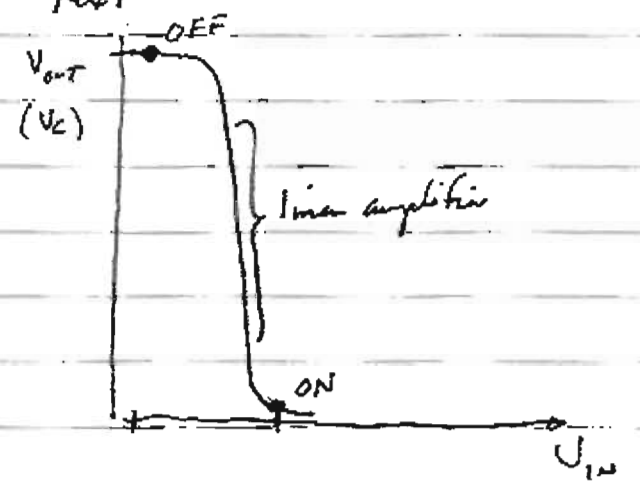
$I_{IB} = 0, 1mA$

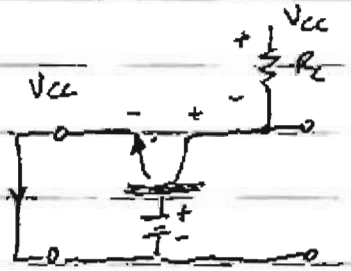
$I_C = 0, 10mA$

$V_C = 5, 0,2 = 0$

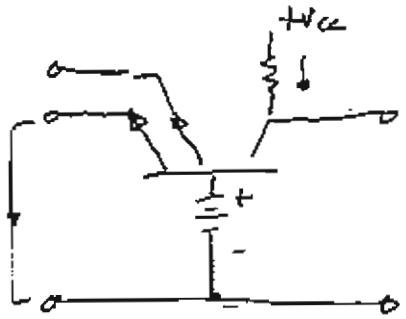
Inverting Switch

fact





Nonlinearly

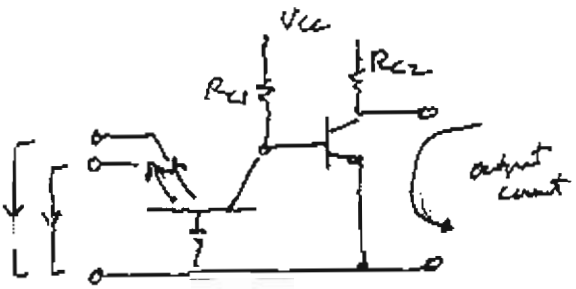


1 = high
0 = low

	input			
	00	01	10	11
output	0	0	0	1

AND Gate

TTL ≈ T^2L



sinking current capability ≡ fan-out

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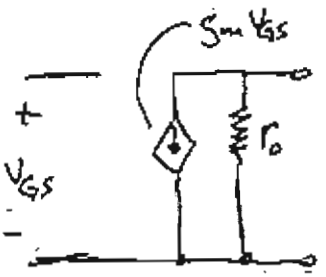
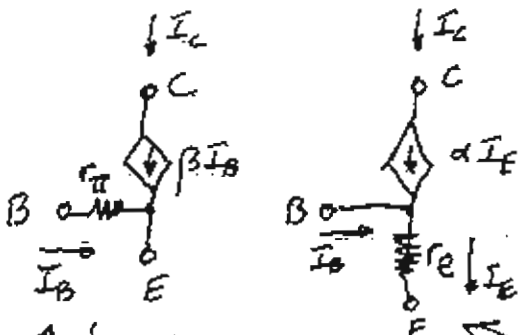
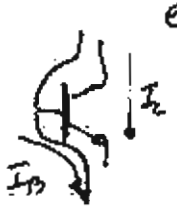
return to comparison

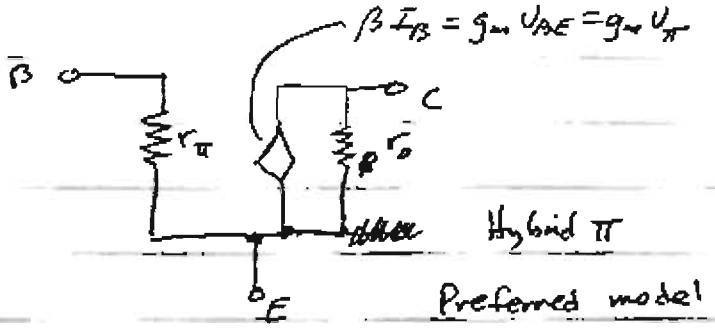




Hybrid π

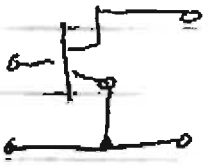


$I_C = I_{CB} = I_{BE}$

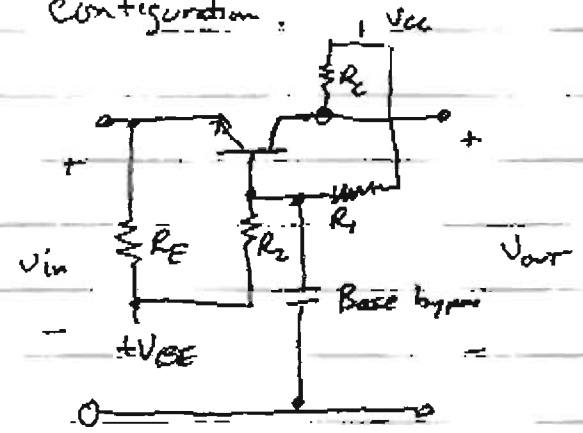


Hybrid π

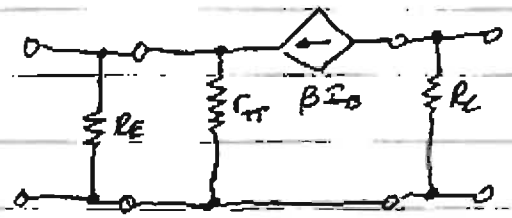
Preferred model



USE common-emitter model (Hybrid π) for any configuration.

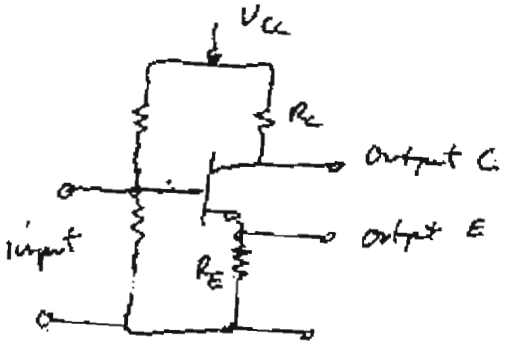


Common-base



Why no R_{BB}? Bypassed

Common-base connection using common emitter model (Hybrid π)

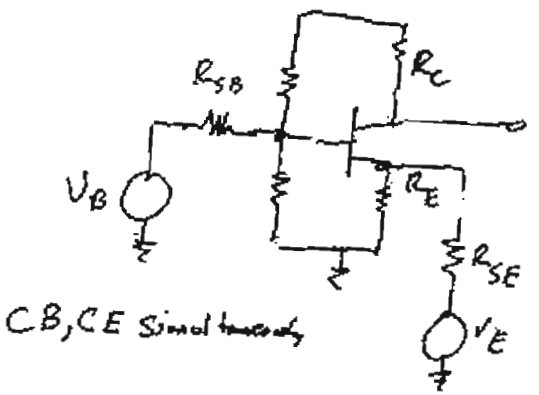


True common-emitter, bypass R_E ⇒ no output E
only output at collector

Almost common emitter; no bypass ⇒ two outputs
at emitter & collector

This CE, CC simultaneously.

INPUT	output(s)	Config	Uses
B	E, C	CC, CE	split output
E	C	CB	current amp
C	—	—	—
E, B	C	CB, CE	difference (differential)

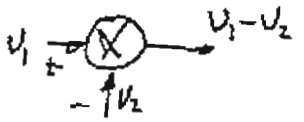


CB, CE simultaneously

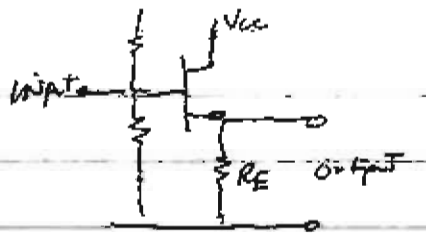
neg pos

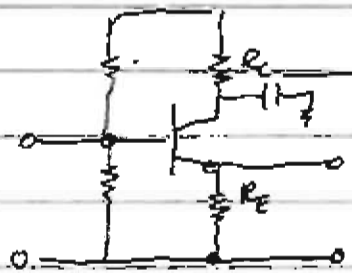
$V_C = A_{VB} V_B + A_{VE} V_E$

= difference between weighted inputs



Common collector





why? dissipate in transistor
move dc Power out of
transistor into R_C

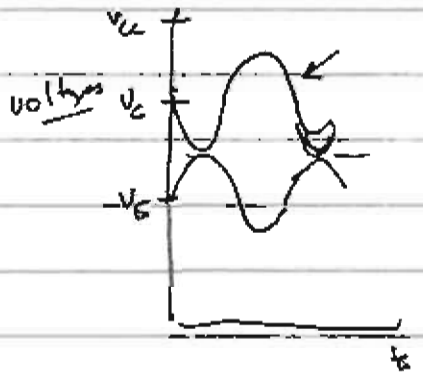
Suppose $V_{cc}=15$

$V_E=3$, $V_{CE}=6$ $V_{RC}=6$, $I_C=10mA$

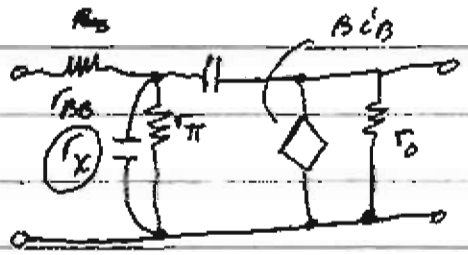
$P_{dc}(Q)=60mW$, $P_{dc}(R_C)=60mW$

no R_C $P_{dc}(Q)=120mW$

$P_{d(max)}=100mW$



extension of Hybrid π



LPF, STC

affects HF response

More To Come