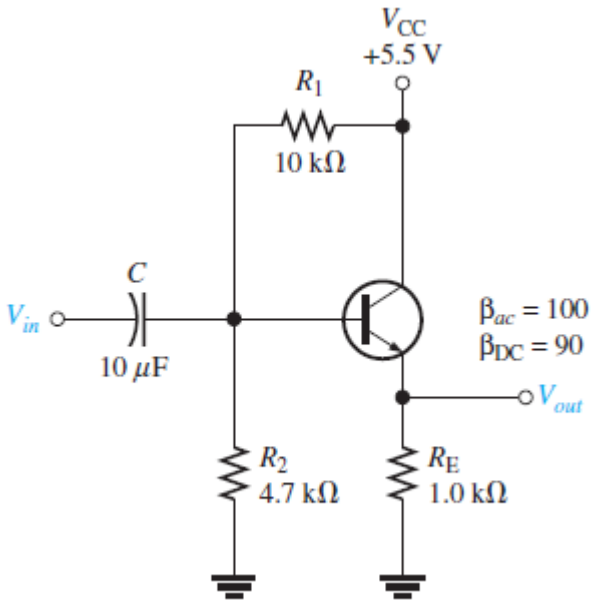
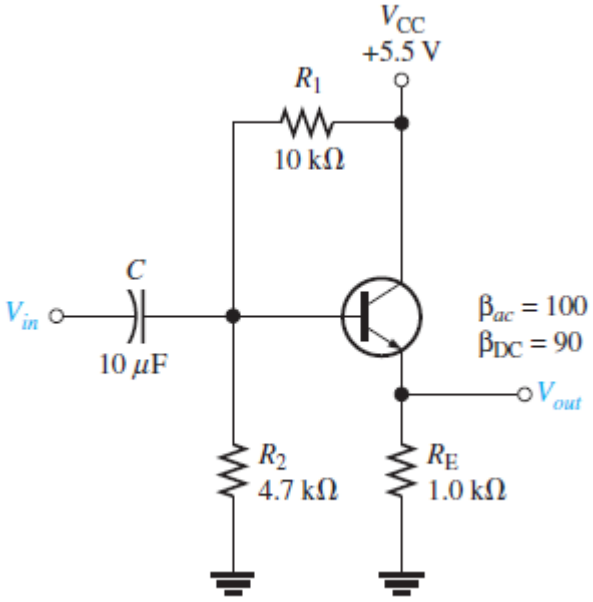
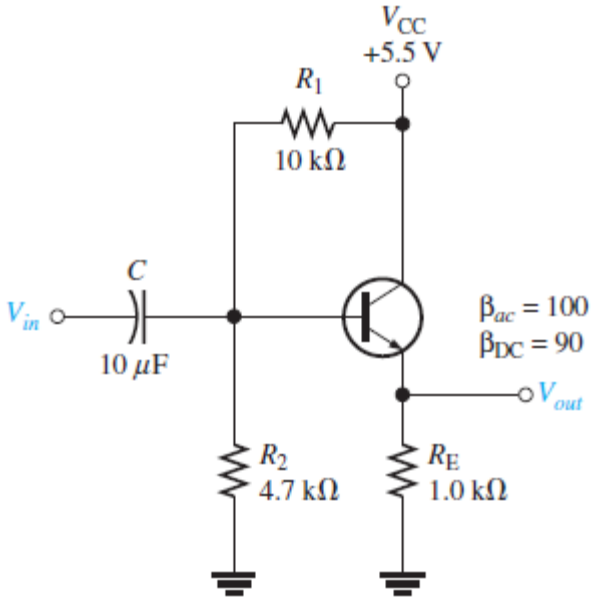
Electronic Circuits II - Tutorial 08

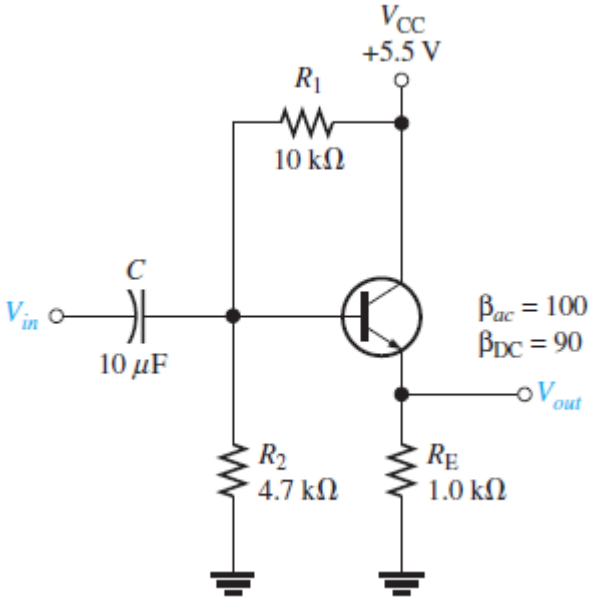
BJT Amplifier 3

Problems

Q1	Determine the *exact* voltage gain for the unloaded emitter-follower in Figure 
Sol 1	…… …… …… …… …… …… …… …… …… …… …… …… …… …… ……

Q2	What is the total input resistance in Figure ? What is the dc output voltage? 
Sol 2	..... $R_{in(tot)} = 3.1\ \text{k}\Omega; V_{OUT} = 1.06\ \text{V}$ .....

Q3	A load resistance is capacitive coupled to the emitter in Figure . In terms of signal operation, the load appears in parallel with *R*E and reduces the effective emitter resistance. How does this affect the voltage gain? 
Sol 3	…… …… …… …… …… …… …… …… …… …… …… …… …… …… ……

Q4	In last Problem, what value of *RL* will cause the voltage gain to drop to 0.9? 
Sol 4	..... 270 Ω .....

Q5

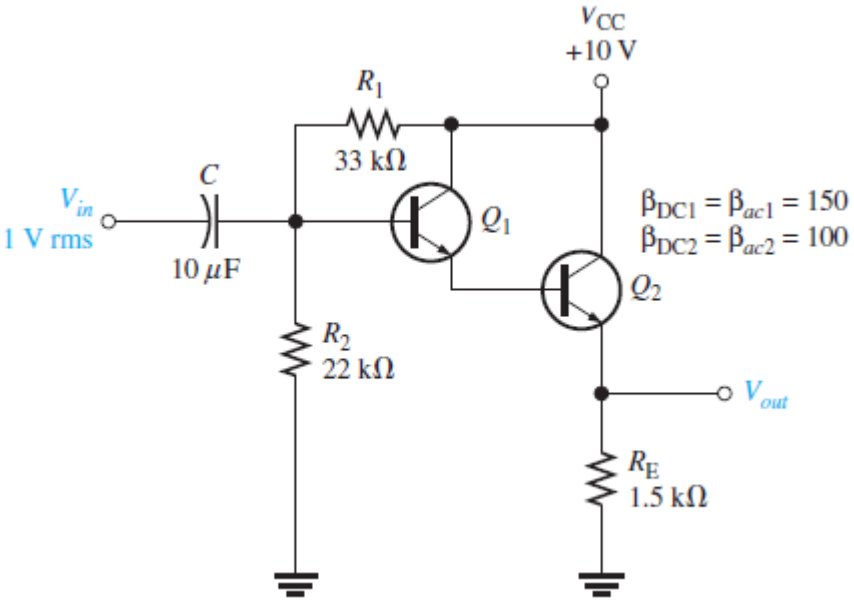
For the circuit in Figure , determine the following:

(a) Q_1 and Q_2 dc terminal voltages

(b) overall β_{ac}

(c) r'_e for each transistor

(d) total input resistance



Sol 5

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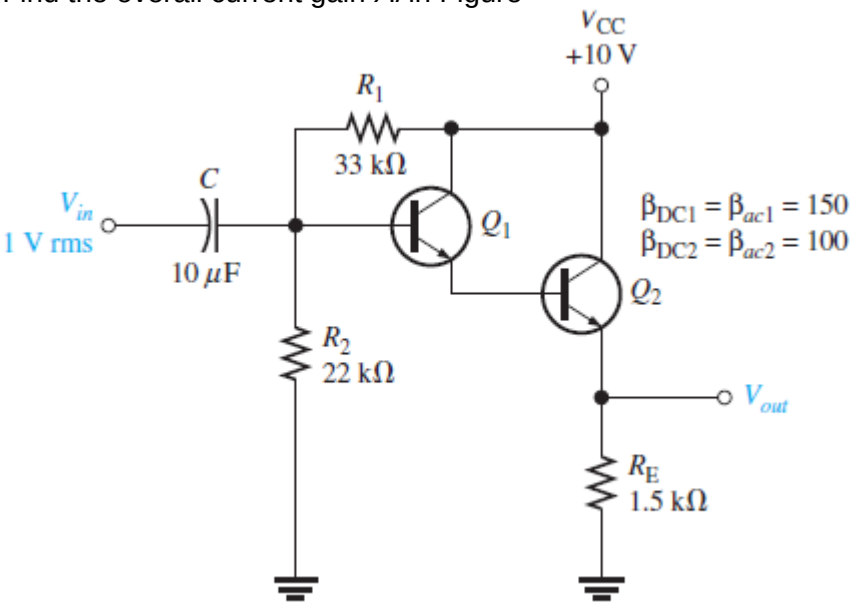
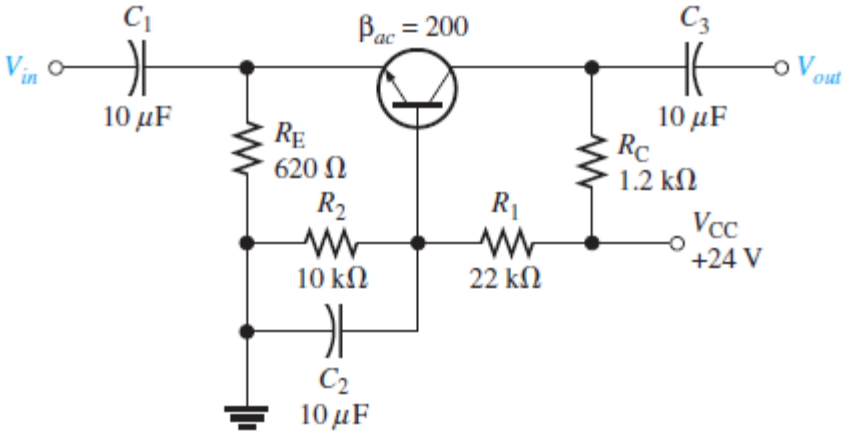
Q6	Find the overall current gain *Ai* in Figure 
Sol 6	..... … 8.8 ....

Q7	What is the main disadvantage of the common-base amplifier compared to the common-emitter and the emitter-follower amplifiers?
Sol 7	…… ……

Q8

Find $R_{in(emitter)}$, A_v, A_i, and A_p for the unloaded amplifier in Figure



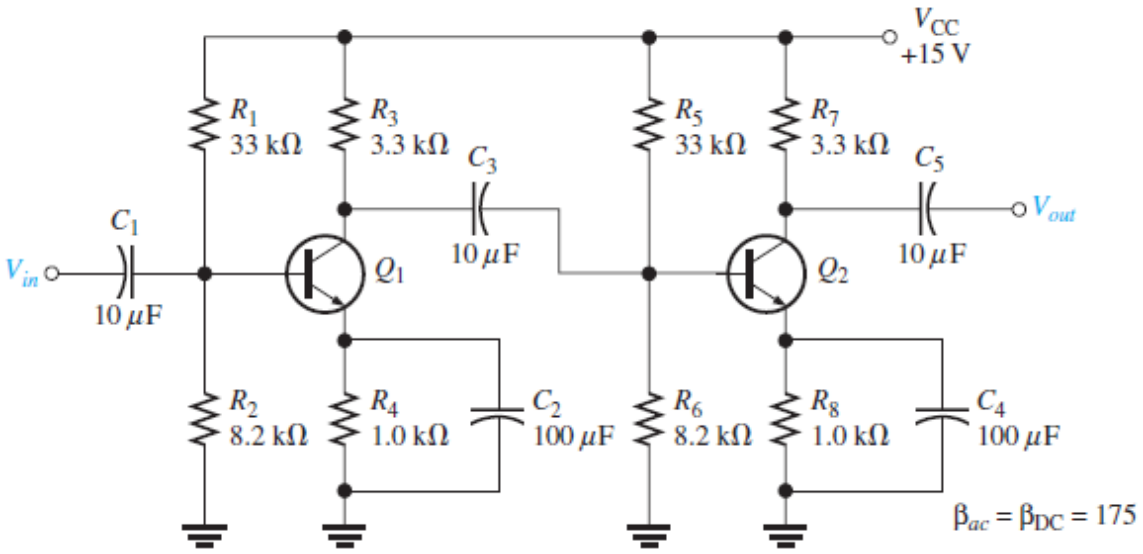
Sol 8

$R_{in(emitter)} = 2.28\ \Omega; A_v = 526; A_i \cong 1; A_p = 526$

Q9	Match the following generalized characteristics with the appropriate amplifier configuration. (a) Unity current gain, high voltage gain, very low input resistance (b) High current gain, high voltage gain, low input resistance (c) High current gain, unity voltage gain, high input resistance
Sol 9	.....

Q10	Each of two cascaded amplifier stages has an $A_v = 20$. What is the overall gain?
Sol 10	.... 400 .....

Q11	Each of three cascaded amplifier stages has a dB voltage gain of 10 dB. What is the overall voltage gain in dB? What is the actual overall voltage gain?
Sol 11	.....

Q12	For the two-stage, capacitively coupled amplifier in Figure , find the following values: **(a)** voltage gain of each stage **(b)** overall voltage gain **(c)** Express the gains found in (a) and (b) in dB. 
Sol 12	(a) $A_{v1} = 93.6, A_{v2} = 303$ (b) $A'_v = 28{,}361$ (c) $A_{v1(\text{dB})} = 39.4\ \text{dB}, A_{v2(\text{dB})} = 49.6\ \text{dB}, A'_{v(\text{dB})} = 89.1\ \text{dB}$

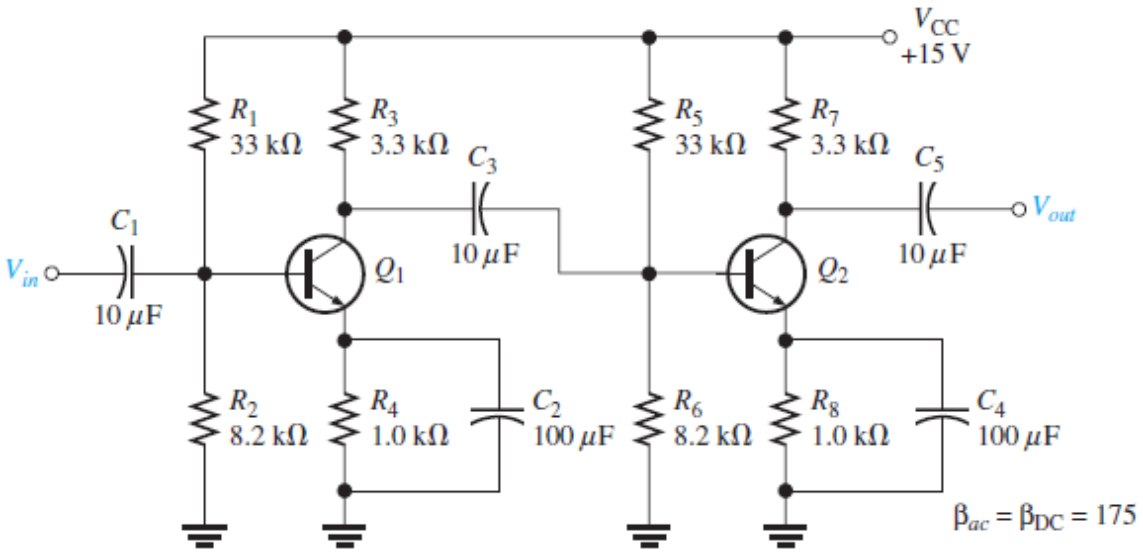
Q13

If the multistage amplifier in Figure is driven by a 75 Ω, 50 μV source and the second stage is loaded with an $R_L = 18\,k\Omega$, determine

(a) voltage gain of each stage

(b) overall voltage gain

(c) Express the gains found in (a) and (b) in dB.



Sol 13

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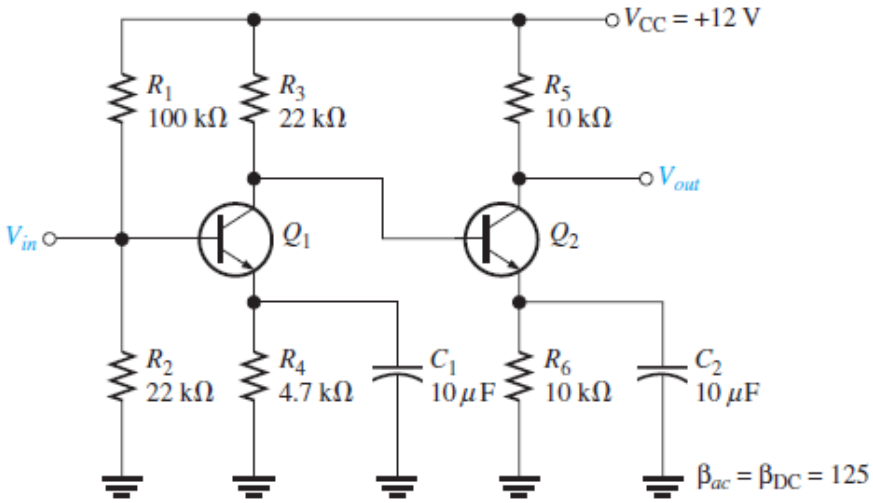
Q14

Figure shows a direct-coupled (that is, with no coupling capacitors between stages) two-stage amplifier. The dc bias of the first stage sets the dc bias of the second. Determine all dc voltages for both stages and the overall ac voltage gain.

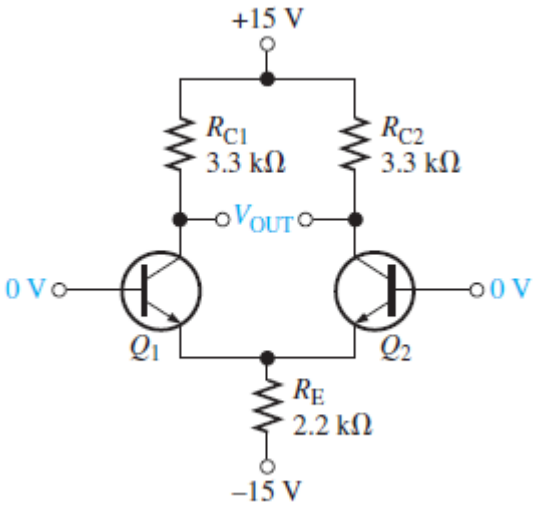


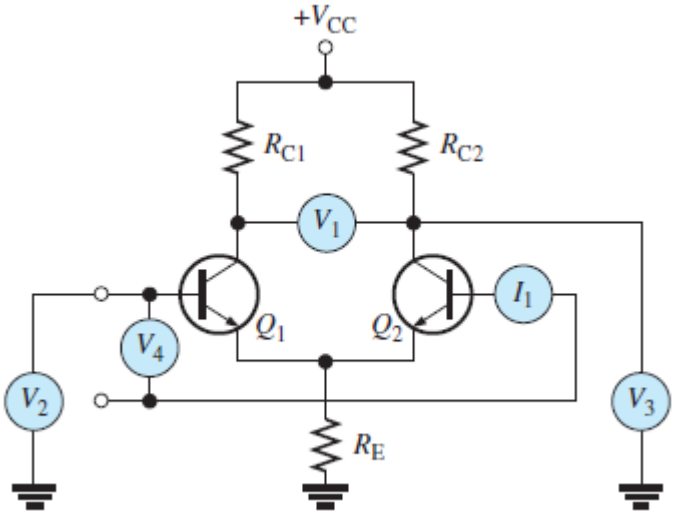
Sol 14

$V_{B1} = 2.16$ V, $V_{E1} = 1.46$ V, $V_{C1} \cong 5.16$ V, $V_{B2} = 5.16$ V,
$V_{E2} = 4.46$ V, $V_{C2} \cong 7.54$ V, $A_{v1} = 66$, $A_{v2} = 179$,
$A'_v = 11{,}814$

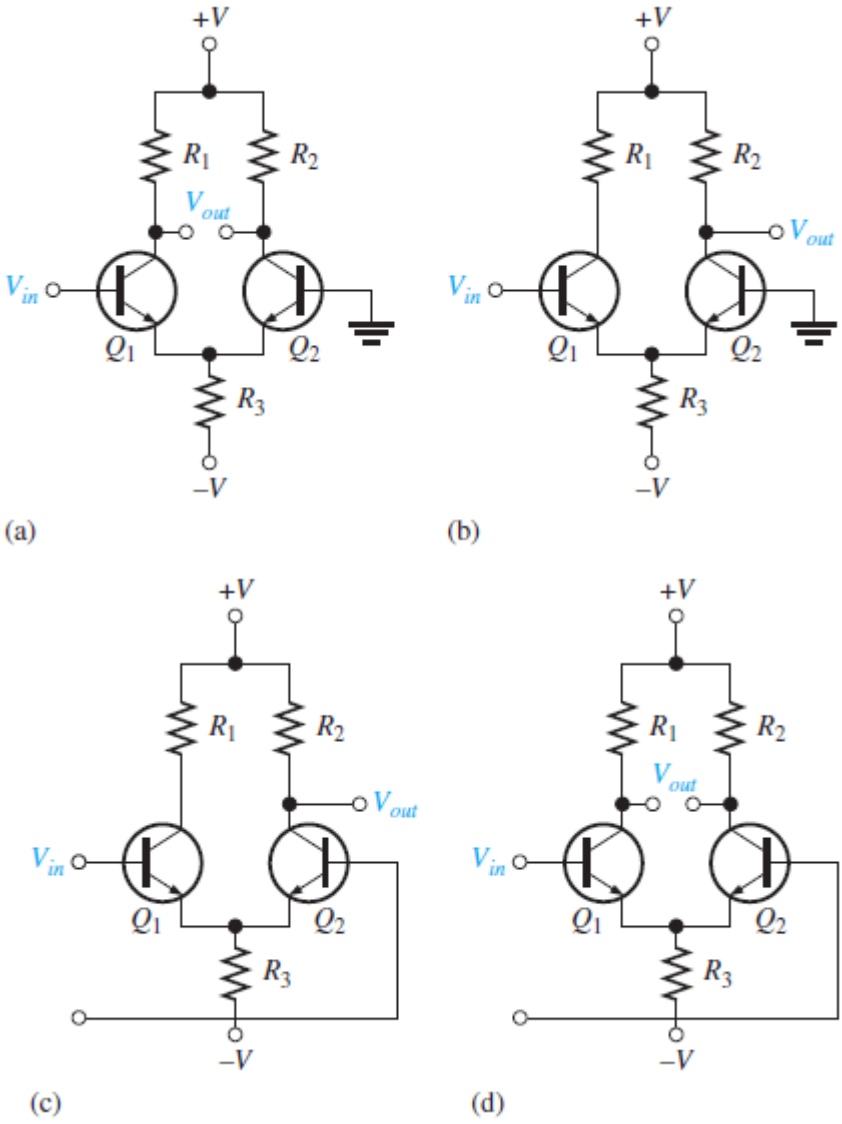
Q15	Express the following voltage gains in dB: (a) 12 (b) 50 (c) 100 (d) 2500
Sol 15	.....

Q16	Express the following voltage gains in dB as standard voltage gains: (a) 3 dB (b) 6 dB (c) 10 dB (d) 20 dB (e) 40 dB
Sol 16	(a) 1.41 (b) 2.00 (c) 3.16 (d) 10.0 (e) 100

Q17	The dc base voltages in Figure are zero. Using your knowledge of transistor analysis, determine the dc differential output voltage. Assume that Q_1 has an $\alpha = 0.980$ and Q_2 has an $\alpha = 0.975$. 
Sol 17	.....

Q18	Identify the quantity being measured by each meter in Figure 
Sol 18	…… …… … V_1: differential output voltage …… … V_2: noninverting input voltage …… … V_3: single-ended output voltage …… … V_4: differential input voltage …… … I_1: bias current …… …… …… …… …… …… …… …… …… …… …… ……

Q19	A differential amplifier stage has collector resistors of 5.1 kΩ each. If $I_{C1} = 1.35$ mA and $I_{C2} = 1.29$ mA, what is the differential output voltage?
Sol 19	.....

Q20	Identify the type of input and output configuration for each basic differential amplifier in Figure 
Sol 20	.... (a) Single-ended differential input; differential output .... (b) Single-ended differential input; single-ended output .... (c) Double-ended differential input; single-ended output .... (d) Double-ended differential input; differential output ....