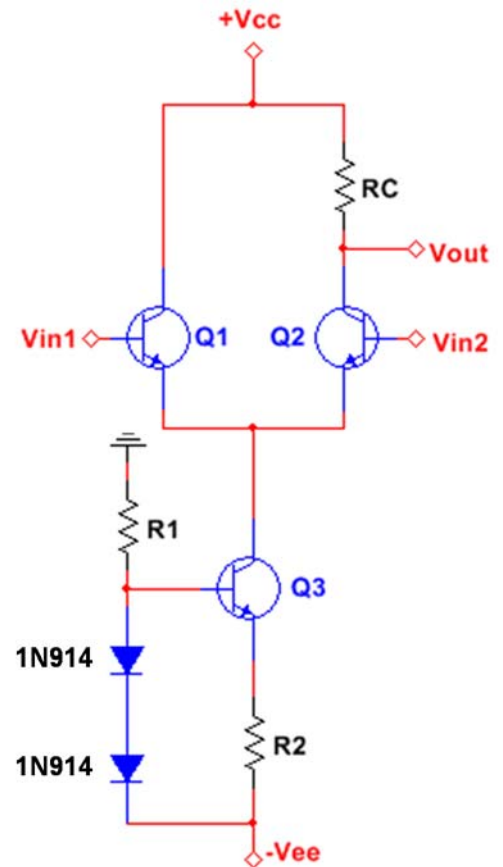


1 problem for 20 pts

Differential amplifier design

Design a differential amplifier with $A_d = 100$ (slightly higher is OK) and $Z_{IN} \geq 10 \text{ kohm}$. The power supplies are $\pm 15\text{V}$, and the current source uses two forward-biased 1N914 diodes. Assume all transistors have the same properties as the 2N3904. Use standard 5% resistors.

- Compute the maximum tail current I_T , assuming Q1 and Q2 have minimum $\beta = 70$.
- Choose appropriate values for R1 and R2, assuming **typical** Q3 parameters. Assume the 1N914 diodes have $V_F = 0.62\text{V @ } 1 \text{ mA}$.
- Based on your chosen R2, compute your actual tail current I_T .
- Based on your actual I_T , choose the appropriate value for R_C , assuming **typical** Q2 parameters.



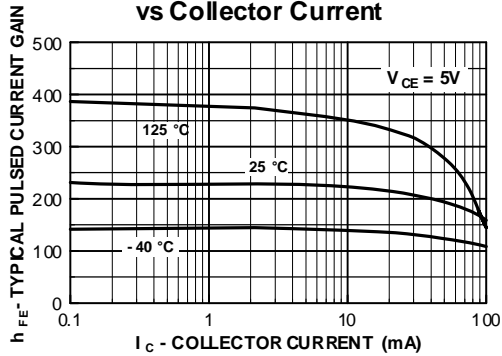
(extra sheet for work)

Standard Resistor Values ($\pm 5\%$)						
1.0	10	100	1.0K	10K	100K	1.0M
1.1	11	110	1.1K	11K	110K	1.1M
1.2	12	120	1.2K	12K	120K	1.2M
1.3	13	130	1.3K	13K	130K	1.3M
1.5	15	150	1.5K	15K	150K	1.5M
1.6	16	160	1.6K	16K	160K	1.6M
1.8	18	180	1.8K	18K	180K	1.8M
2.0	20	200	2.0K	20K	200K	2.0M
2.2	22	220	2.2K	22K	220K	2.2M
2.4	24	240	2.4K	24K	240K	2.4M
2.7	27	270	2.7K	27K	270K	2.7M
3.0	30	300	3.0K	30K	300K	3.0M
3.3	33	330	3.3K	33K	330K	3.3M
3.6	36	360	3.6K	36K	360K	3.6M
3.9	39	390	3.9K	39K	390K	3.9M
4.3	43	430	4.3K	43K	430K	4.3M
4.7	47	470	4.7K	47K	470K	4.7M
5.1	51	510	5.1K	51K	510K	5.1M
5.6	56	560	5.6K	56K	560K	5.6M
6.2	62	620	6.2K	62K	620K	6.2M
6.8	68	680	6.8K	68K	680K	6.8M
7.5	75	750	7.5K	75K	750K	7.5M
8.2	82	820	8.2K	82K	820K	8.2M
9.1	91	910	9.1K	91K	910K	9.1M

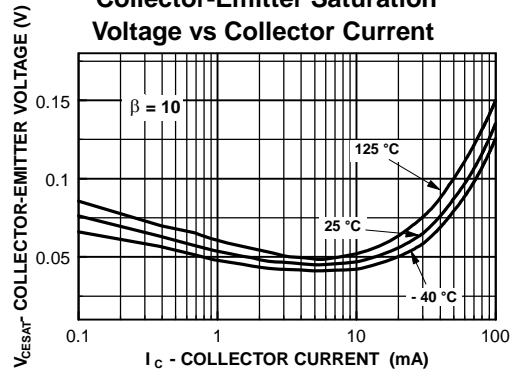
Standard Capacitor Values ($\pm 10\%$)						
10pF	100pF	1000pF	.010 μ F	.10 μ F	1.0 μ F	10 μ F
12pF	120pF	1200pF	.012 μ F	.12 μ F	1.2 μ F	
15pF	150pF	1500pF	.015 μ F	.15 μ F	1.5 μ F	
18pF	180pF	1800pF	.018 μ F	.18 μ F	1.8 μ F	
22pF	220pF	2200pF	.022 μ F	.22 μ F	2.2 μ F	22 μ F
27pF	270pF	2700pF	.027 μ F	.27 μ F	2.7 μ F	
33pF	330pF	3300pF	.033 μ F	.33 μ F	3.3 μ F	33 μ F
39pF	390pF	3900pF	.039 μ F	.39 μ F	3.9 μ F	
47pF	470pF	4700pF	.047 μ F	.47 μ F	4.7 μ F	47 μ F
56pF	560pF	5600pF	.056 μ F	.56 μ F	5.6 μ F	
68pF	680pF	6800pF	.068 μ F	.68 μ F	6.8 μ F	
82pF	820pF	8200pF	.082 μ F	.82 μ F	8.2 μ F	

Typical Performance Characteristics

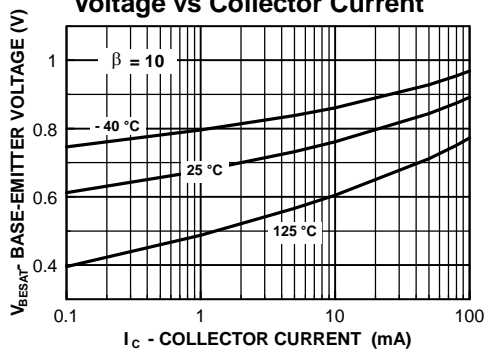
Typical Pulsed Current Gain vs Collector Current



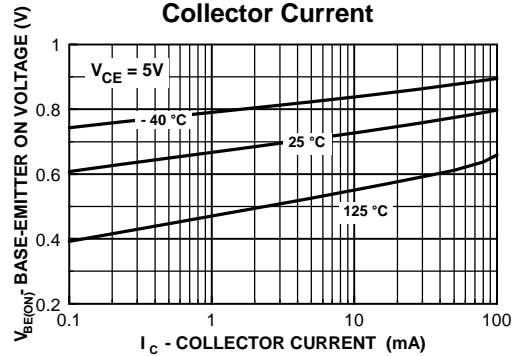
Collector-Emitter Saturation Voltage vs Collector Current



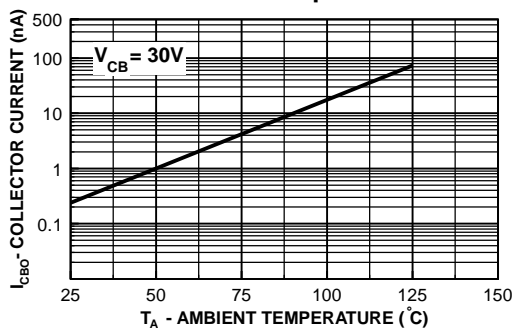
Base-Emitter Saturation Voltage vs Collector Current



Base-Emitter ON Voltage vs Collector Current



Collector-Cutoff Current vs Ambient Temperature



Capacitance vs Reverse Bias Voltage

