$V_S = 4.5V$

10k

R_X
39k

10k

R_t
6.8k ±1%*

8

5

7

6

LM331

C_t
0.01 μF*

C1
470 pF

f_{IN}

2

1

Q1

V_{OUT}

4

3

1 μF

R_L*

R_S

12k ±1%*

0.01 μF

5k*
GAIN
ADJUST

Q1 = 2N4250, 2N3906 or similar
high-beta PNP transistor
Select $R_X = [(V_S - 3V)/3V]$
X 10 kΩ

*Use stable components with
low temperature coefficients