uA733 Video Amplifier - Ratio Tolerancing
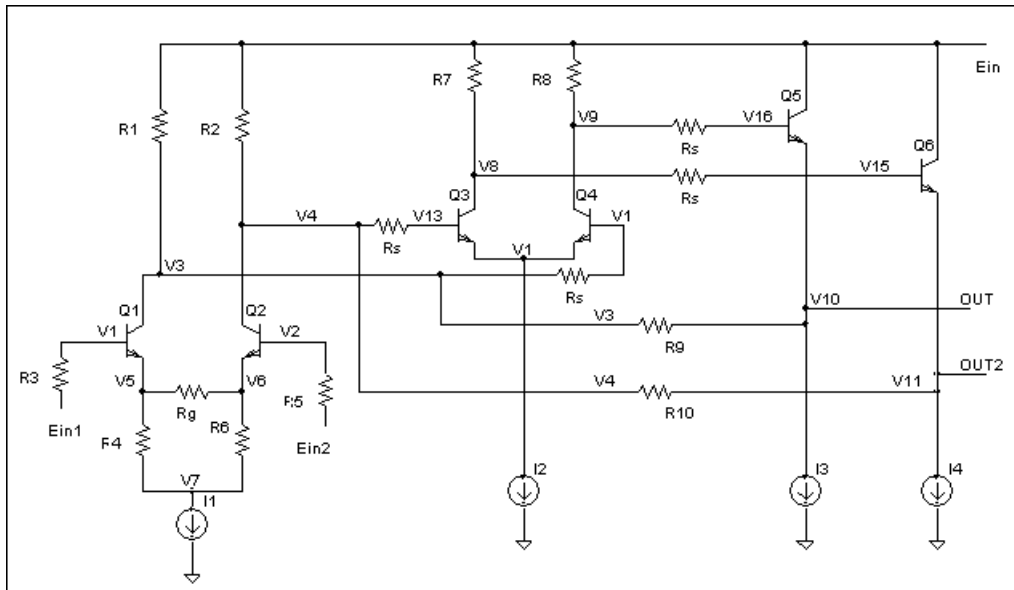

This device is a VHF Video Amplifier The sensitivities of this IC are given below. The constant-current-sources are analyzed and included in the sensitivities, although it turns out their sensitivities are not of concern. I1 and I2 are 5.63 mA while I3 and I4 are 4.26 mA. With the values of R4 and R6 given in the M-file, the nominal gain is 10 V/V.

The components with significant sensitivity levels are R1, R2, R4, R6, and to a lesser extent R11 and R12. These monolithic resistors were undoubtedly laid down with ratioed tolerances.

```
Ie =
   5.6258e-003   4.2635e-003
Vo =
   10.4044
Sen =
   15.2051      R1
  -15.1765      R2
   -0.0143
  -17.0727      R4
    0.0135
   16.0937      R6
    0.3370
   -0.2404
    2.3606      R11
   -1.4473      R12
    0.0689
    0.0194
    0.0391
   -0.0071
    0.0072
```

Constant current source:
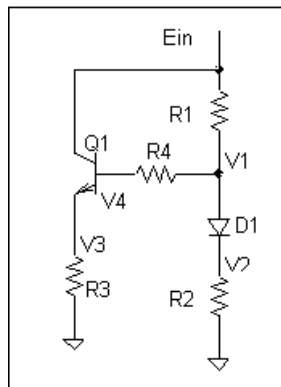

```
See M-Files uA733.m, ccs.m, & VA7.m
```

The circuit equations are obtained in a slightly different manner than for opamp circuits. Some nodal equations are given below. A Vbe refinement iteration using the diode equation is employed after an initial guess of Vbe = 0.6V. This sequence is at the end of the function M-files VA7.m and ccs.m.

$$\frac{E1 - V1}{R3} = Ib1, \qquad \frac{E2 - V2}{R5} = Ib2, \qquad \frac{E3 - V3}{R1} = B1 \cdot Ib1 + Ib4 + \frac{V3 - V10}{R11}$$

This continues for all 12 nodes. The Vbe equations are initialized as, for example, Vbe1 = V1 − V5 = 0.6
This is repeated for the remaining five BJT's giving a total of 18 equations for the 12 unknown node voltages and 6 unknown base currents Ib1 thru Ib6.

All of the equations can be reconstucted from the rows of the A matrix and B column vector.

<u>uA733 Monte Carlo Analysis</u>

The M-file below generates the histogram for the uA733 shown following the listing. The text output below is the nominal magnitude of the two current sources and the differential gain in V/V. This M-file uses ratio tolerancing. See M-File daratio.m and page 66 of the book "Tolerance Analysis of Electronic Circuits Using MATLAB", CRC Press, 1999

```
Ie =
   5.6258e-003      4.2635e-003
Vo =
   10.0002
```