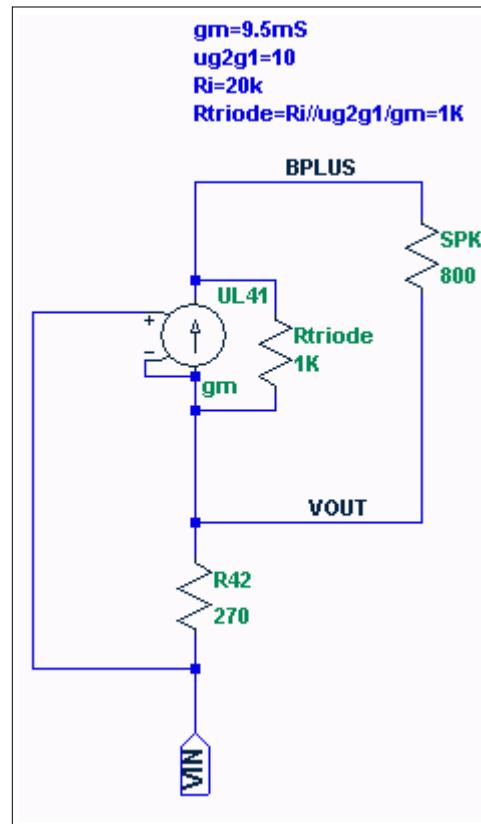


UL41 Tube example from Philips BX2553



Circuit derivation for upper half of U41/EL84 Totem Pole in Philips BX2553 OTL audio output.
January 19th 2010, Joe Sousa
Equations manipulated with Maple in Mathcad 6.0

Node voltage equations:

$$\frac{BPLUS - VOUT}{SPK} + \frac{BPLUS - VOUT}{Rtriode} + gm(VIN - VOUT) = 0$$

$$\frac{VOUT - VIN}{R42} + \frac{VOUT - BPLUS}{SPK} + \frac{VOUT - BPLUS}{Rtriode} - gm(VIN - VOUT) = 0$$

Solve for VOUT:

$$VOUT = \frac{-\left(\frac{1}{SPK} + \frac{1}{Rtriode}\right)}{\frac{-1}{SPK} - \frac{1}{Rtriode} - gm}$$

$$SPK := 800 \quad Rtriode := 1000 \quad R42 := 270 \quad gm := 0.0095$$

$$VOUT := \frac{-\left(\frac{1}{SPK} + \frac{1}{Rtriode}\right)}{\frac{-1}{SPK} - \frac{1}{Rtriode} - gm}$$

$$VOUT = 0.191 \quad R42 \text{ has 19% of the drop from BPLUS to VIN}$$

$$Iin := \frac{VOUT}{R42}$$

$$Iin = 0.000709$$

Input AC drive current from lower EL84 stage

$$Rin := \frac{BPLUS - VIN}{Iin}$$

$$Rin = 1410$$

Load impedance that the EL84 must drive.
It is roughly double the impedance of the speaker, as expected.

Ground VIN and force a unit voltage at BPLUS.
(Only first equation is needed):

$$VIN := 0 \quad BPLUS := 1$$

$$\frac{1 - VOUT}{SPK} + \frac{1 - VOUT}{Rtriode} - gm \cdot VOUT = 0$$