

## Finding the Thevenin Equivalent Circuit for the EPOT-Based Offset Resistor Network

Additional Information: [EPOT Applications: Offset Adjustment in Op-Amp Circuits](#)

To model the network shown below in Figure 1 as the Thevenin equivalent shown below in Figure 2, find the Thevenin Voltage ( $V_{th}$ ) and the Thevenin Resistance ( $R_{th}$ ). In this case,  $V_{th}$  is the same as  $V_{os}$  (with no external load present) and  $R_{th}$  is the resistance looking back from  $V_{os}$  with the voltage sources shorted out. Start by replacing the EPOT with its Thevenin equivalent and then substitute that replacement into the original network.

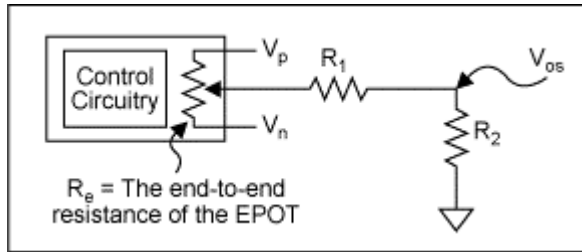


Figure 1.

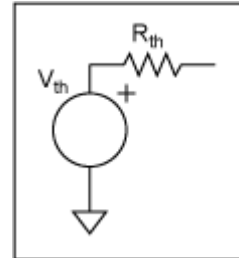


Figure 2.

Note 1: In this analysis,  $N = (\text{Current EPOT setting}) / (\text{total number of taps})$ . In other words, for a 32 tap EPOT, a setting of 8 makes  $N = 0.25$ .

Note 2:  $V_p$  = the positive supply voltage and  $V_n$  = the negative supply voltage

Note 3:  $V_{pot}$  = the voltage at the wiper of the EPOT

$$V_{pot} = V_p - \left[ N \cdot R_e \cdot \frac{(V_p - V_n)}{R_e} \right] \quad (1)$$

$$V_{pot} = V_p - [N \cdot (V_p - V_n)]$$

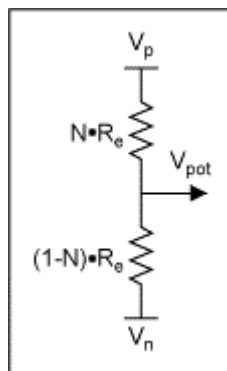


Figure 3.

To find the EPOT's equivalent resistance ( $R_{pot}$ ), short out the sources, i.e. it's just the two resistances in parallel.

$$\frac{1}{R_{pot}} = (N \cdot R_e) \parallel [(1-N) \cdot R_e] = \frac{(1-N) \cdot R_e + N \cdot R_e}{N \cdot (1-N) \cdot R_e \cdot R_e} \quad (2)$$

$$R_{pot} = N \cdot (1-N) \cdot R_e$$

The final step is to substitute the Thevenin circuit for the EPOT into the original circuit and find the overall Thevenin replacement.

$$V_{os} = \frac{V_{pot} \cdot R_2}{R_{pot} + R_1 + R_2} = \frac{\{V_p - [N \cdot (V_p - V_n)]\} \cdot R_2}{N \cdot (1-N) + R_1 + R_2} \quad (3)$$

$$R_{th} = (R_{pot} + R_1) \parallel R_2 = (N \cdot (1-N) + R_1) \parallel R_2 \quad (4)$$

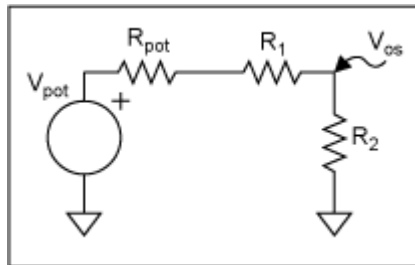


Figure 4.

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