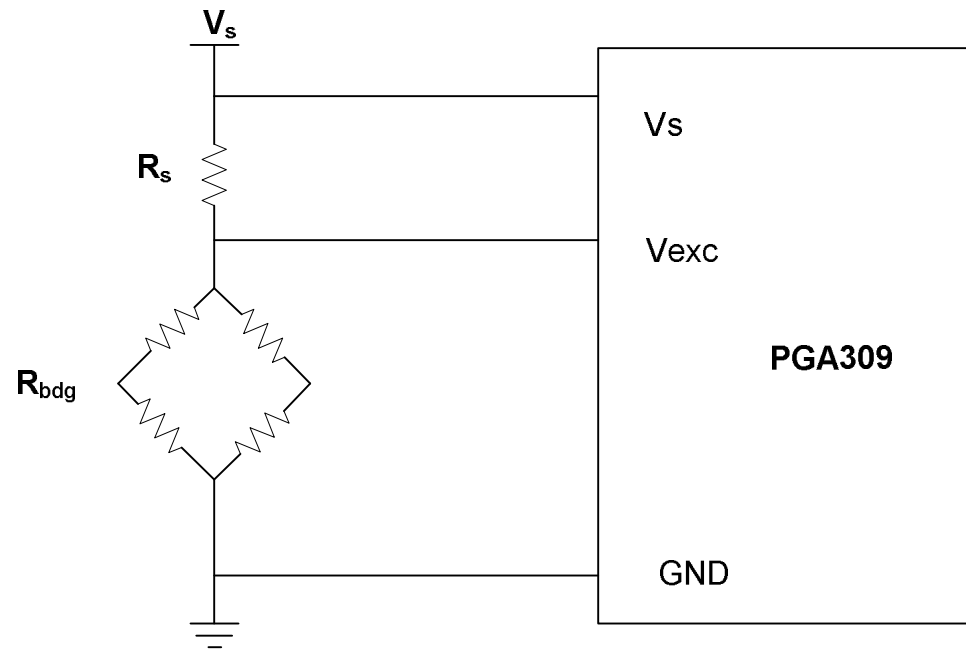


PGA309 V_{exc} Pull-Up Procedure for Selecting R_s

1/7/08

Typical Pull-up Configuration



Currents In Pull-up configuration

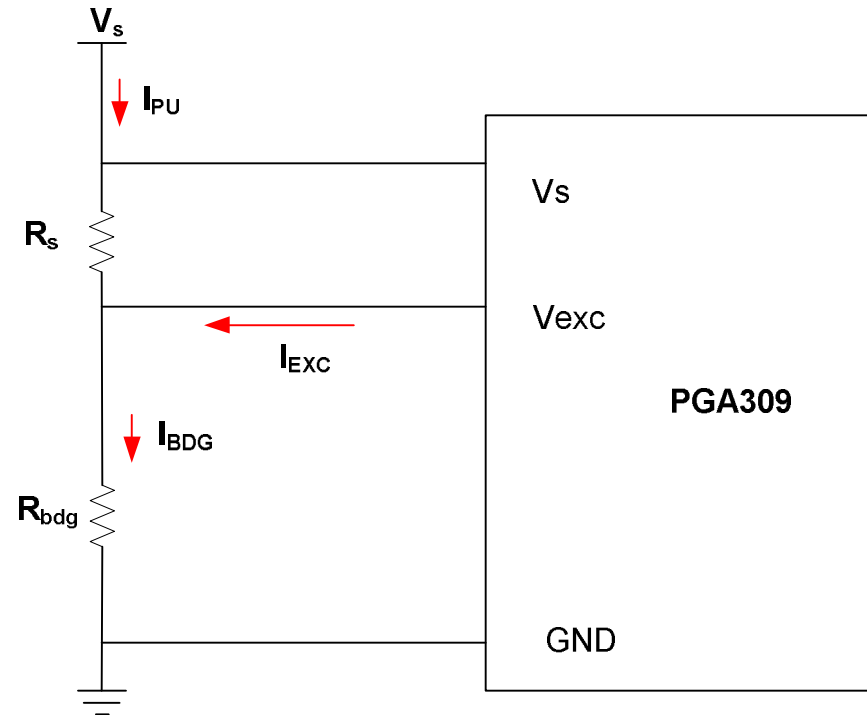
(Note that V_{exc} changes to eliminate nonlinearity)

$$I_{BRG_MAX} = \frac{V_{exc_max}}{R_{bdg}} \quad I_{BRG_MIN} = \frac{V_{exc_min}}{R_{bdg}}$$

$$I_{PU_MIN} = \frac{(V_s - V_{exc_max})}{R_s} \quad I_{PU_MAX} = \frac{V_s - V_{exc_min}}{R_s}$$

$$(I_{PU_MIN} - I_{BRG_MAX}) < 5mA$$

$$(I_{PU_MAX} - I_{BRG_MIN}) > -5mA$$



The two extremes with 5mA maximum out of Vexc

For the widest swing of Vexc use the extremes below

$$\frac{(V_s - V_{exc_max})}{R_s} - \frac{V_{exc_max}}{R_{bdg}} = 5mA \quad \text{Eq1: Set the current out of Vexc pin to +5mA when Vexc = max}$$

$$\frac{(V_s - V_{exc_min})}{R_s} - \frac{V_{exc_min}}{R_{bdg}} = -5mA \quad \text{Eq2: Set the current out of Vexc pin to -5mA when Vexc = min}$$

$$I_{pu} - I_{bdg} = I_{vexc}$$

The two formulas above limit the output of the Vexc pin to 5mA.

Solve for Rs (two solutions)

Solve Eq1 and Eq2 for Rs. Note that there are two solutions we will solve for both values and test the results.

$$R_{s1} = (V_s - V_{\text{exc_max}}) \cdot \frac{R_{\text{bdg}}}{V_{\text{exc_max}} - 0.005 R_{\text{bdg}}}$$

$$R_{s2} = (V_s - V_{\text{exc_min}}) \cdot \frac{R_{\text{bdg}}}{V_{\text{exc_min}} + 0.005 R_{\text{bdg}}}$$

Example Results

Find Rs for the two extremes -- Example values

$$V_s := 5 \quad V_{\text{exc_max}} := 4.15 \quad R_{\text{bdg}} := 350 \quad V_{\text{exc_min}} := 3.4$$

$$R_{s1} := (V_s - V_{\text{exc_max}}) \cdot \frac{R_{\text{bdg}}}{V_{\text{exc_max}} - 0.005 R_{\text{bdg}}} \quad R_{s1} = 123.958$$

$$R_{s2} := (V_s - V_{\text{exc_min}}) \cdot \frac{R_{\text{bdg}}}{V_{\text{exc_min}} + 0.005 R_{\text{bdg}}} \quad R_{s2} = 108.738$$

Test Example Results

Test I_{exc} at V_{exc} min for R_{s1}

$$I_{exc_min1} := \frac{(V_s - V_{exc_max})}{R_{s1}} - \frac{V_{exc_max}}{R_{bdg}} \quad I_{exc_min1} = -5 \times 10^{-3}$$

$$I_{exc_max1} := \frac{(V_s - V_{exc_min})}{R_{s1}} - \frac{V_{exc_min}}{R_{bdg}} \quad I_{exc_max1} = 3.193 \times 10^{-3}$$

Test I_{exc} at V_{exc} min for R_{s2}

$$I_{exc_min2} := \frac{(V_s - V_{exc_max})}{R_{s2}} - \frac{V_{exc_max}}{R_{bdg}} \quad I_{exc_min2} = -4.04 \times 10^{-3}$$

$$I_{exc_max2} := \frac{(V_s - V_{exc_min})}{R_{s2}} - \frac{V_{exc_min}}{R_{bdg}} \quad I_{exc_max2} = 5 \times 10^{-3}$$

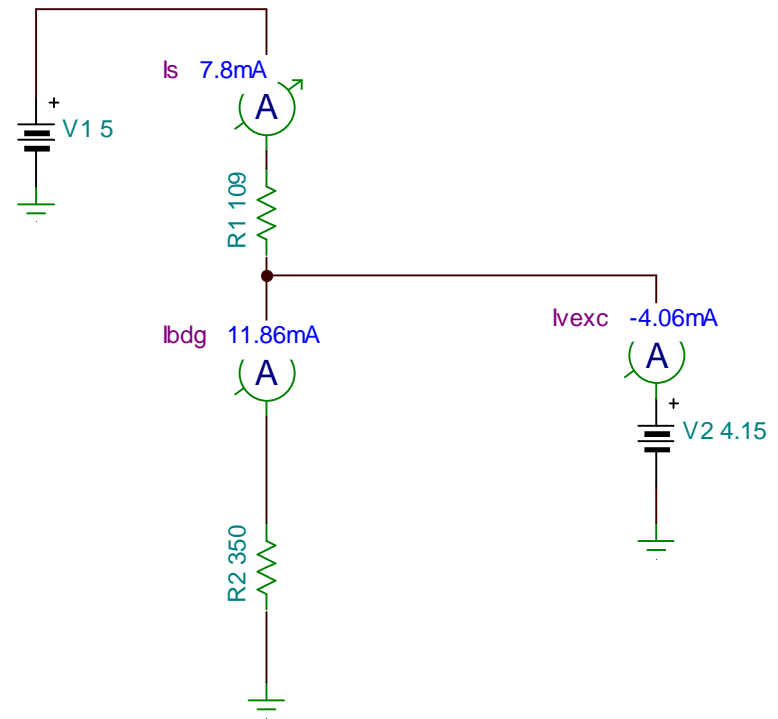
You can use Tina spice to test results

$$V_s := 5 \quad V_{\text{exc_max}} := 4.15 \quad R_{\text{bdg}} := 350 \quad V_{\text{exc_min}} := 3.4$$

Test I_{exc} at $V_{\text{exc_min}}$ for R_{s2}

$$I_{\text{exc_min2}} := \frac{(V_s - V_{\text{exc_max}})}{R_{s2}} - \frac{V_{\text{exc_max}}}{R_{\text{bdg}}} \quad I_{\text{exc_min2}} = -4.04 \times 10^{-3}$$

$$I_{\text{exc_max2}} := \frac{(V_s - V_{\text{exc_min}})}{R_{s2}} - \frac{V_{\text{exc_min}}}{R_{\text{bdg}}} \quad I_{\text{exc_max2}} = 5 \times 10^{-3}$$



You can use Tina spice to test results

$$V_s := 5 \quad V_{\text{exc_max}} := 4.15 \quad R_{\text{bdg}} := 350 \quad V_{\text{exc_min}} := 3.4$$

Test I_{exc} at $V_{\text{exc_min}}$ for R_{s2}

$$I_{\text{exc_min2}} := \frac{(V_s - V_{\text{exc_max}})}{R_{s2}} - \frac{V_{\text{exc_max}}}{R_{\text{bdg}}} \quad I_{\text{exc_min2}} = -4.04 \times 10^{-3}$$

$$I_{\text{exc_max2}} := \frac{(V_s - V_{\text{exc_min}})}{R_{s2}} - \frac{V_{\text{exc_min}}}{R_{\text{bdg}}} \quad I_{\text{exc_max2}} = 5 \times 10^{-3}$$

