Procedure for Selecting UV/OV External Resistor Values

The following 3-step procedure helps select the resistor values for the resistive divider of Figure 4. This procedure minimizes UV and OV offset errors caused by leakage currents at the respective pins.

1. Choose maximum tolerable offset at the UV pin, $V_{OS(UV)}$. Divide by the worst case leakage current at the UV pin, I_{UV} (10nA). Set the sum of R1 + R2 equal to $V_{OS(UV)}$ divided by 10nA. Note that due to the presence of R3, the actual offset at UV will be slightly lower:

$$R1 + R2 = \frac{V_{OS(UV)}}{I_{UV}}$$

2. Select the desired V_{IN} UV trip threshold, UV_{TH}. Find the value of R3:

$$R3 = \frac{V_{OS(UV)}}{I_{UV}} \bullet \left(\frac{UV_{TH} - 0.5V}{0.5V} \right)$$

3. Select the desired V_{IN} OV trip threshold, OV_{TH}. Find the values of R1 and R2:

$$R1 = \frac{\left(\frac{V_{OS(UV)}}{I_{UV}} \right) + R3}{OV_{TH}} \bullet 0.5V$$

$$R2 = \frac{V_{OS(UV)}}{I_{UV}} - R1$$

The example of Figure 4 uses standard 1% resistor values. The following parameters were selected:

$V_{OS(UV)} = 3mV$

$I_{UV} = 10nA$

$UV_{TH} = 5V$

$OV_{TH} = 18V$

The resistor values can then be solved:

1. $R1 + R2 = \frac{3mV}{10nA} = 300k$

2. $R3 = 2 \bullet \frac{3mV}{10nA} \bullet (5V - 0.5V) = 2.7M$

The closest 1% value: R3 = 2.74M:

3. $R1 = \frac{300k + 1.82M}{2 \bullet 18V} = 84.4k$

The closest 1% value: R1 = 84.5k:

R2 = 300k – 84.5k = 215.5k

The closest 1% value: R2 = 215k

Therefore: OV = 17.99V, UV = 5.07V.

◦ Jetson UV and OV Threshold:

The $V_{OS(UV)}$ is the max voltage deviation that you can get at that output. The current output is $I_{(UV)}$ which is a 10nA output.

1.) Find $R_1 + R_2$

$$R_1 + R_2 = \frac{V_{OS(UV)}}{I_{UV}}$$

$$R_1 + R_2 = \frac{3mV}{10nA} = \frac{0.003V}{10 \times 10^{-9}} = 300K$$

2.) Find R_3 using UV trip threshold

$$R_3 = \frac{V_{OS(UV)}}{I_{UV}} \cdot \left(\frac{UV_{TH} - 0.5V}{0.5V} \right)$$

Set UV_{TH} = 18V

$$R_3 = (300K)\left(\frac{18V - 0.5V}{0.5V} \right) = 10.5M\Omega$$

3.) Find R_1 using OV trip threshold

$$R_1 = \frac{\left(\frac{V_{OV(UV)}}{I_{UV}} \right) + R_3}{OV_{TH}} \cdot 0.5V$$

$$R_1 = \frac{300k + 10.5M\Omega}{21V} \cdot 0.5V$$

$$= 257142.8571\,\Omega$$

$R_1 \approx 260k\Omega$

4.) Find R_2

$R_1 + R_2 = 300k$

$R_2 = 300k - R_1$

$R_2 = 40k = 300k - 260k\Omega$

For Jetson Load SW!

$R_1 = 260k\Omega$ UV = 18V

$R_2 = 40k\Omega$ OV = 21V

$R_3 = 10.5M\Omega$

OBC UV and OV Thresholds

1.) Find R_1+R_2

$$R_1+R_2 = \frac{V_{OS(UV)}}{1uV}$$

$$R_1+R_2 = \frac{3mV}{10nA} = \frac{0.003V}{10\times10^{-9}} = 300K$$

2.) Find R_3 using UV trip threshold

$$R_3 = \frac{V_{OS(UV)}}{1nV} \cdot \left(\frac{UV_{TH} - 0.5V}{0.5V}\right)$$

Set $UV_{TH} = 11V$

$$R_3 = (300k)\left(\frac{11V - 0.5V}{0.5V}\right) = 6.3\ M\Omega$$

3.) Find R_1 using OV trip threshold

$$R_1 = \frac{\left(\frac{V_{OV(UV)}}{1W}\right) + R_3}{OV_{TH}} \cdot 0.5V$$

$$R_1 = \frac{300k + 6.3\ M\Omega}{13V} \cdot 0.5V$$

$$= 253846.1538\ \Omega$$

$R_1 \approx 250\ k\Omega$

4.) Find R_2

$$R_1+R_2 = 300k$$

$$R_2 = 300k - R_1$$

$$R_2 = 300k - 250k$$

$$R_2 = 50k\Omega$$

For OBC Load SW:

$R_1 = 250\ k\Omega$ $\quad$ $UV = 11V$

$R_2 = 50k\Omega$ $\quad$ $OV = 13V$

$R_3 = 6.3\ M\Omega$

FPGA/+5V Perif UV and OV Threshold's

1.) Find R_1+R_2

$$R_1+R_2 = \frac{V_{OS(UV)}}{I_{UV}}$$

$$R_1+R_2 = \frac{3mV}{10nA} = \frac{0.003V}{10\times10^{-9}} = 300K$$

2.) Find R_3 using UV trip threshold

$$R_3 = \frac{V_{OS(UV)}}{I_{UV}} \cdot \left(\frac{UV_{TH} - 0.5V}{0.5V}\right)$$

Set UV_{TH} = 4 V

$$R_3 = (300K)\left(\frac{4V - 0.5V}{0.5V}\right) = 2.1\,M\Omega$$

3.) Find R_1 using OV trip threshold

$$R_1 = \frac{\left(\frac{V_{OV(UV)}}{I_{UV}}\right) + R_3}{OV_{TH}} \cdot 0.5V$$

Set OV_{TH} = 6V

$$R_1 = \frac{300k + 2.1\,M\Omega}{6V} \cdot 0.5V$$

$$= 200000\,\Omega$$

$$R_1 = 200k\Omega$$

4.) Find R_2

$$R_1+R_2 = 300k$$

$$R_2 = 300k - R_1$$

R_2 =

For FPGA/5V perif Load SW's

R_1 = 200 kΩ UV = 4 V

R_2 = 100kΩ OV = 6 V

R_3 = 2.1 MΩ