Simple Voltage Divider Calculator with *Uncertainty* Calculated via Partial Derivatives

Note
Variance is for an stats study.

Absolute Uncertainty of f

$$\Delta_{abs}(f\#) := \left| \begin{array}{l} x\# := \text{Unknowns}(f\#)\ \ fs\# := \text{num2str}(f\#)\ \ xs\# := \overrightarrow{\text{num2str}(x\#)} \\ \left| \begin{array}{l} f\# \\ \text{length}(xs\#) \\ \sum_{k\#=1} \text{str2num}\left(\text{concat}\left("\text{abs(diff(}", fs\#, ",", xs\#_{k\#}, "))*\Delta", xs\#_{k\#}\right)\right) \end{array} \right| \end{array} \right|$$

Relative Uncertainty of f

$$\Delta_{rel}(f\#) := \left| \begin{array}{l} x\# := \text{Unknowns}(f\#)\ \ fs\# := \text{num2str}(f\#)\ \ xs\# := \overrightarrow{\text{num2str}(x\#)} \\ \left| \begin{array}{l} f\# \\ \frac{1}{f\#} \cdot \sum_{k\#=1}^{\text{length}(xs\#)} \text{str2num}\left(\text{concat}\left("\text{abs(diff(}", fs\#, ",", xs\#_{k\#}, "))*\Delta", xs\#_{k\#}\right)\right) \cdot x\#_{k\#} \end{array} \right| \end{array} \right|$$

Inputs:

Input voltage

$V_{in} := 27\ \text{V}$

Input voltage variance

$\Delta V_{in} := 1\ \% \cdot V_{in}$

Upper voltage divider resistor R1

$R1 := 20\ \text{k}\Omega$

R1 variance using tol

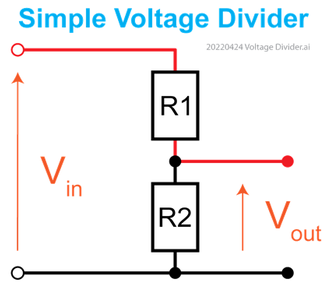
$\Delta R1 := 2\ \% \cdot R1$

Lower voltage divider resistor R2

$R2 := 30\ \text{k}\Omega$

R2 variance using tol

$\Delta R2 := 5\ \% \cdot R2$



Formulas:

Vout formula

$$\Delta := \left| \begin{array}{l} \text{Clear}(V_{in}, R1, R2) \\ \Delta_{abs}\left(V_{in} \cdot \frac{R2}{R1 + R2}\right) \end{array} \right| \qquad \begin{bmatrix} V_{out} \\ \Delta V_{out} \end{bmatrix} := \Delta$$

Outputs:

Nominal output voltage

$V_{out} = 16.2\ \text{V}$

Output voltage variance

$\Delta V_{out} = 615.6\ \text{mV}$

Nominal output voltage range

$V_{out} \pm \Delta V_{out} = \begin{cases} 16.8156 \\ 15.5844 \end{cases} \text{V}$

With relative uncertainities

$\Delta V_{in} := 1\ \%$ $\Delta R1 := 2\ \%$ $\Delta R2 := 5\ \%$

Formulas:

Vout formula

$$\Delta := \left| \begin{array}{l} \text{Clear}(V_{in}, R1, R2) \\ \Delta_{rel}\left(V_{in} \cdot \frac{R2}{R1 + R2}\right) \end{array} \right| \qquad \begin{bmatrix} V_{out} \\ \Delta V_{out} \end{bmatrix} := \Delta$$

Outputs:

Nominal output voltage

$V_{out} = 16.2\ \mathrm{V}$

Output voltage variance

$\Delta V_{out} = 3.8\ \%$

Nominal output voltage range

$V_{out} \cdot \left(1 \pm \Delta V_{out}\right) = \begin{cases} 16.8156 \\ 15.5844 \end{cases} \mathrm{V}$

Alvaro