

Vout variation for TLV431AI based error amplifier

$$V_{\text{out_nom}} := 5\text{V} \quad R_{\text{FBU}} := 41.2\text{k}\Omega \quad R_{\text{FBL}} := 13.3\text{k}\Omega \quad V_{\text{REF}} := 1.24\text{V} \quad \text{PPM} := 10^{-6}$$

$$V_{\text{out_calc}} := V_{\text{REF}} \cdot \frac{R_{\text{FBU}} + R_{\text{FBL}}}{R_{\text{FBL}}} = 5.081\text{V} \quad \Delta T_{\text{temp}} := 125\text{K}$$

TLV431AI tolerances

$$V_{\text{ref_tol25}} := 1\% \quad \Delta V_{\text{ref_temtyp}} := 6\text{mV} \quad \Delta V_{\text{ref_tol25}} := V_{\text{ref_tol25}} \cdot V_{\text{REF}} = 0.012\text{V}$$

$$\text{Resistors CRCW0603 type with 1% nominal tolerance} \quad R_{\text{tol}} := 1\% \quad R_{\text{tol_temp}} := 100 \frac{\text{PPM}}{\text{K}}$$

$$\Delta R_{\text{FBU}} := R_{\text{FBU}} \cdot R_{\text{tol}} = 0.412\text{k}\Omega \quad \Delta T R_{\text{FBU}} := R_{\text{FBU}} \cdot R_{\text{tol_temp}} \cdot \Delta T_{\text{temp}} = 0.515\text{k}\Omega$$

$$\Delta R_{\text{FBL}} := R_{\text{FBL}} \cdot R_{\text{tol}} = 0.133\text{k}\Omega \quad \Delta T R_{\text{FBL}} := R_{\text{FBL}} \cdot R_{\text{tol_temp}} \cdot \Delta T_{\text{temp}} = 0.166\text{k}\Omega$$

$$P1 := \frac{d}{dV_{\text{REF}}} \left(V_{\text{REF}} \cdot \frac{R_{\text{FBU}} + R_{\text{FBL}}}{R_{\text{FBL}}} \right) \cdot \Delta V_{\text{ref_tol25}} = 0.051\text{V}$$

$$\frac{R_{\text{FBU}} + R_{\text{FBL}}}{R_{\text{FBL}}}$$

$$P2 := \frac{d}{dV_{\text{REF}}} \left(V_{\text{REF}} \cdot \frac{R_{\text{FBU}} + R_{\text{FBL}}}{R_{\text{FBL}}} \right) \cdot \Delta V_{\text{ref_temtyp}} = 0.025\text{V}$$

$$P3 := \frac{d}{dR_{\text{FBU}}} \left(V_{\text{REF}} \cdot \frac{R_{\text{FBU}} + R_{\text{FBL}}}{R_{\text{FBL}}} \right) \cdot \Delta R_{\text{FBU}} = 0.038\text{V}$$

$$\frac{1}{R_{\text{FBL}}} \cdot V_{\text{REF}}$$

$$P4 := \frac{d}{dR_{\text{FBU}}} \left(V_{\text{REF}} \cdot \frac{R_{\text{FBU}} + R_{\text{FBL}}}{R_{\text{FBL}}} \right) \cdot \Delta T R_{\text{FBU}} = 0.048\text{V}$$

$$-\frac{1}{R_{\text{FBL}}^2} \cdot R_{\text{FBU}} \cdot V_{\text{REF}}$$

$$P5 := \frac{d}{dR_{\text{FBL}}} \left(V_{\text{REF}} \cdot \frac{R_{\text{FBU}} + R_{\text{FBL}}}{R_{\text{FBL}}} \right) \cdot \Delta R_{\text{FBL}} = -0.038\text{V}$$

$$P6 := \frac{d}{dR_{\text{FBL}}} \left(V_{\text{REF}} \cdot \frac{R_{\text{FBU}} + R_{\text{FBL}}}{R_{\text{FBL}}} \right) \cdot \Delta T R_{\text{FBL}} = -0.048\text{V}$$

$$RSS_{\text{Tol25}} := \sqrt{P1^2 + P3^2 + P5^2} = 0.074\text{V} \quad RSS_{\text{TolTemp}} := \sqrt{P2^2 + P4^2 + P6^2} = 0.072\text{V}$$

$$RSS_{\text{Total}} := \sqrt{P1^2 + P2^2 + P3^2 + P4^2 + P5^2 + P6^2} = 0.104\text{V}$$