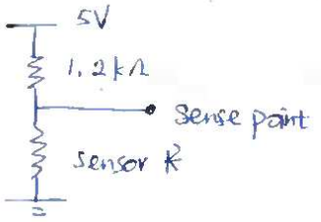
2022/07/22

Temp Sensor F 0.15(A) — Normal Resistance 1kΩ



$\Rightarrow R = R_0 * (1 + a \times T + b \times T^2)$ for $T \geq 0^\circ C$

$R = R_0 \times [1 + a \times T + b \times T^2 + c\,(T - 100^\circ C) \times T^3]$ For $T < 0^\circ C$

only concern $T > 0^\circ C$ situation

$$V_{sense} = \frac{R}{1.2k + R} \times 5 \Rightarrow \frac{V}{5}(1.2k + R) = R$$

$$\frac{V}{5} \cdot 1.2k + \frac{V}{5}R = R$$

$$\frac{V}{5} \times 1.2k = (1 - \frac{V}{5})R$$

~~$R = 1 - \frac{V}{5}$~~

$$R = \frac{\frac{V \times 1.2k}{5}}{(1 - \frac{V}{5})}$$

$V(1.2k + R) = 5R$

$V \times 1.2k = (5 - V)R$

$$R = \frac{1.2k \cdot V}{5 - V}$$

$R = 1k \times (1 + a \times T + b \times T^2)$

$$\frac{R}{1k} = 1 + a \times T + b \times T^2$$

$$b \times T^2 + a \times T + 1 - \frac{R}{1k} = 0$$

$$T = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-a \pm \sqrt{a^2 - 4b \times (1 - \frac{R}{1k})}}{2b}$$

$V = 2361.6mV$

$$R = \frac{1.2k \times V}{5 - V}$$

$$= \frac{1.2k \times 2.3616}{5 - 2.3616}$$

≈ 1074.1Ω

$C = T - 273.15$

$$T = \frac{-3.8083 \times 10^{-3} \pm \sqrt{(3.8083)^2 \times 10^{-6} - 4 \times (-5.775 \times 10^{-7})(1 - 1.0741)}}{2 \times (-5.775 \times 10^{-7})}$$

if ± ⇒ + $T = 19.0457$

if ± ⇒ − $T = 6777.8$ too big

$$T = \frac{-a \pm \sqrt{a^2 - 4b(1 - R)}}{2b}$$

kΩ

$a = 3.8083E-03$

$b = -5.775E-07$

$c = -4.183E-12$

$$T = \frac{-3.8083 \times 10^{-3} + \sqrt{(3.8083 \times 10^{-3})^2 + 4 \times 5.775 \times 10^{-7} \times (1 - 1.0741)}}{-2 \times 5.775 \times 10^{-7}}$$

$$= \frac{3.8083 \times 10^{-3} - \sqrt{(3.8083 \times 10^{-3})^2 + 4 \times 5.775 \times 10^{-7}(1 - 1.0741)}}{2 \times 5.775 \times 10^{-7}}$$

$$T = \frac{-3.8083 \times 10^{-3} \pm \sqrt{(3.8083)^2 \times 10^{-6} - 4 \times (-5.775 \times 10^{-7}) \times (1 - R)}}{2 \times (-5.775E-07)}$$

Touch it by hand. (37°C probably)

Skin temp may lower

$V_{sense} = 2380.8\ mV$

$$R = \frac{1.2k \times 2.3808\ V}{5 - 2.3808}$$

$$= \frac{2856.96}{2.6192}$$

$$= 1090.776\ \Omega$$

$$= 1090.8\ \Omega$$

$$T = \frac{-3.9083 \times 10^{-3} + \sqrt{(3.9083 \times 10^{-3})^2 + 4 \times 5.775 \times 10^{-7} \times (1 - 1.0908}}{-2 \times 5.775 \times 10^{-7}}$$

$T \approx 23.4°C$ skin temp