Thermistor Resistance and Temperature (β Equation)

Resistance of an NTC thermistor at a temperature from R25 and β, and the temperature from a measured resistance, with the sensitivity per kelvin.

Method: NTC β model R = R₀ exp[β (1/T − 1/T₀)]

Input parameters

Unit system: SI

Parameter	Value	Unit
Resistance at the reference temperature	10,000	Ω
Reference temperature	25.000	°C
β constant (K)	3,950.0	
Temperature (to find R)	50.000	°C
Measured resistance (to find T)	6,000.0	Ω

Calculated results

Parameter	Value	Unit
Resistance at T	3,588.2	Ω
Temperature at the measured resistance	36.957	°C
Sensitivity at T, (1/R) dR/dT = −β/T² (per kelvin)	-0.037826	1/K

Notes for this case

• The β equation fits a limited range (typically ±50 K around the reference); use Steinhart–Hart for wide ranges. Sensitivity is per kelvin.

Formula and method

$$R_T = R_0\, e^{\beta(1/T - 1/T_0)}, \quad \frac{1}{T} = \frac{1}{T_0} + \frac{1}{\beta}\ln\frac{R}{R_0}$$

Variables

R_0	Resistance at the reference temperature	Ω
T_0	Reference temperature	K
β	β constant (K)	-
T	Temperature (to find R)	K
R_m	Measured resistance (to find T)	Ω
R_T	Resistance at T	Ω
T_R	Temperature at the measured resistance	K
α	Sensitivity at T, (1/R) dR/dT = −β/T² (per kelvin)	1/K

Method and standards

Two-parameter NTC model.

Assumptions and limits

- NTC thermistor.

References

• NTC β model R = R₀ exp[β (1/T − 1/T₀)]

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/instrumentation/temperature/thermistor-beta

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.