Functionality of PSpice Models for Vishay's PTCSL03 PTC Sensors

The PSpice libraries and symbols (.lib and .olb files), downloaded from the Vishay web page, are functional for PSpice DC, AC sweep, and time transient simulations.

In order to allow the simultaneous use of the Monte Carlo analysis and temperature parametric sweep, the TEMP variable is replaced by another user-specific parameter named myTEMP in the library, which must be defined by the user in PARAM. At the opposite of TEMP, the parameter myTEMP has no other temperature effect than on the PTC component, except if the user defines it in their simulation.

In order to show the functionality of the models, the following PSpice simulations were performed using Cadence's OrCAD 16.6 PSpice program and compared to specifications, in addition to some experimental measurements when available.

REPRODUCTION OF THE RESISTANCE TEMPERATURE CURVES

A Monte Carlo analysis (500 runs) was performed using a spread of 10 % (Gaussian distribution) on R_{25}. The simulations are compared to the specification limits and to nominal measurements in fig. 1. Only a few curves of the Monte Carlo sample are represented, among which are the min. and the max. computed.

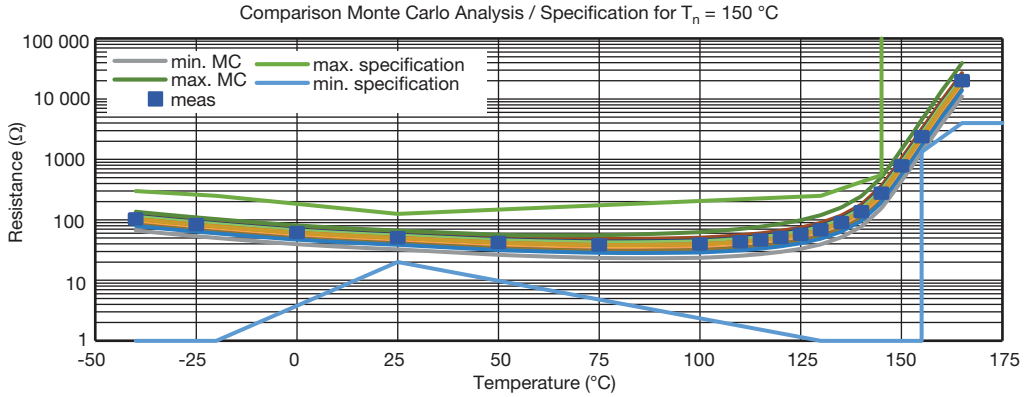


Fig. 1 - Resistance Temperature Curve for the PTCSL03T151 (Switch Temperature of 150 °C)

The whole specification span between T_n - 5 °C (550 Ω max.) and T_n + 5 °C (1330 Ω min.) is statistically well-covered by our Monte Carlo analysis.

It is also possible with these results to perform a performance analysis (XatNthY) in order compute the distributions of component temperature corresponding to resistance values of 550 Ω (fig. 2) and 1330 Ω (fig. 3)

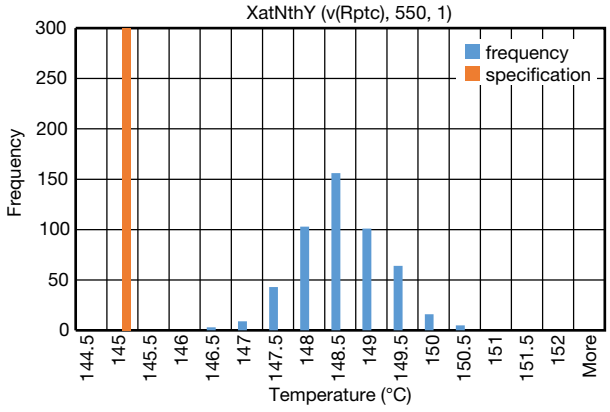


Fig. 2

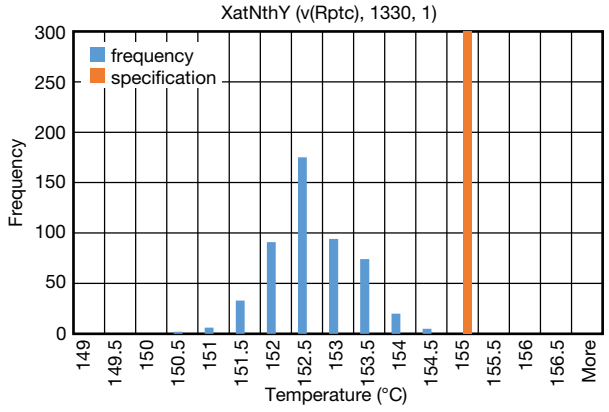


Fig. 3

The same comparison between simulations and specifications of figure 1 was performed for component with a switch temperature of 120 °C (PTCSL03T121) and is presented in fig. 4. Again only a few curves of the Monte Carlo analysis are represented, among which are the min. and max. values detected during the analysis.

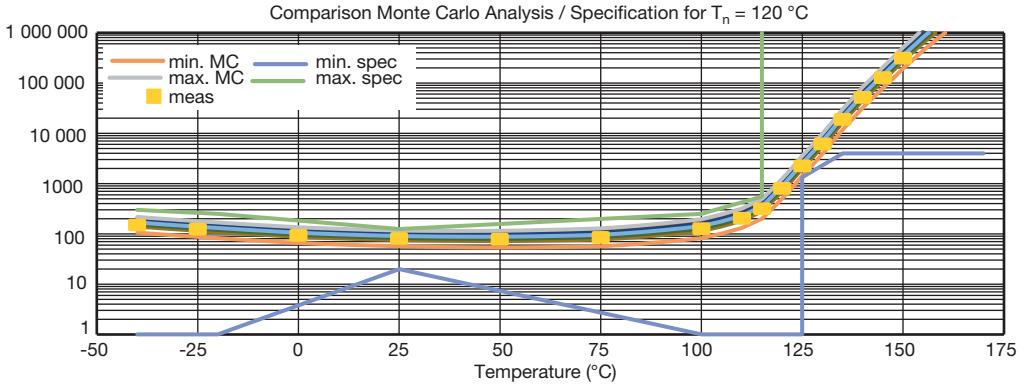


Fig. 4 - Resistance Temperature Curve for the PTCSL03T121 (Switch Temperature of 120 °C)

VOLTAGE / CURRENT DEPENDENCE

A sweep simulation of voltage applied to the PTC component provides the expected generated current curve form, showing that the self-heating due to power dissipation is taken into account. A secondary sweep is done for ambient temperature (myTEMP). See fig. 5.

In the graph below, the simulation curves are blue and measurement points are orange.

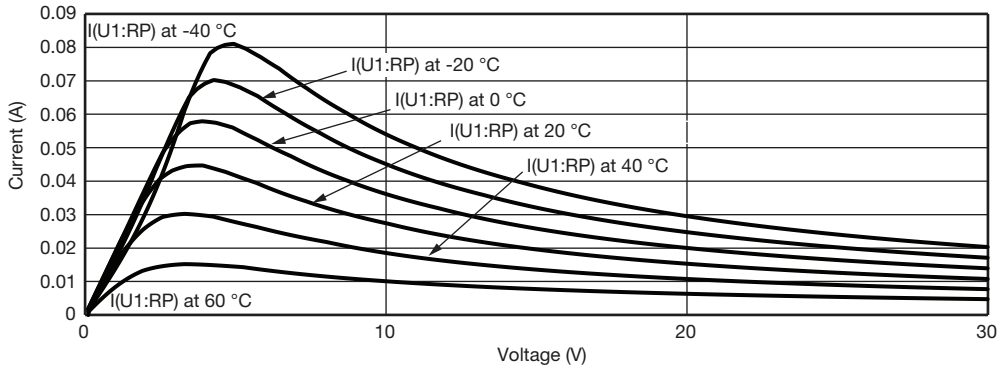
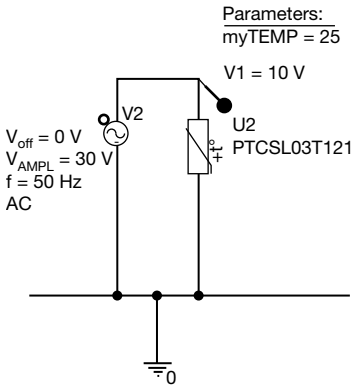


Fig. 5 - Voltage / Current Curve for PTCSL03T081 (Switch Temperature of 80 °C)

TRANSIENT ANALYSIS WITH AN AC SOURCE

Connecting an AC source of ampliture 30 V and frequency 50 Hz as drawn hereunder and measuring the current flowing into the PTC component provides the following current decay (fig. 6)



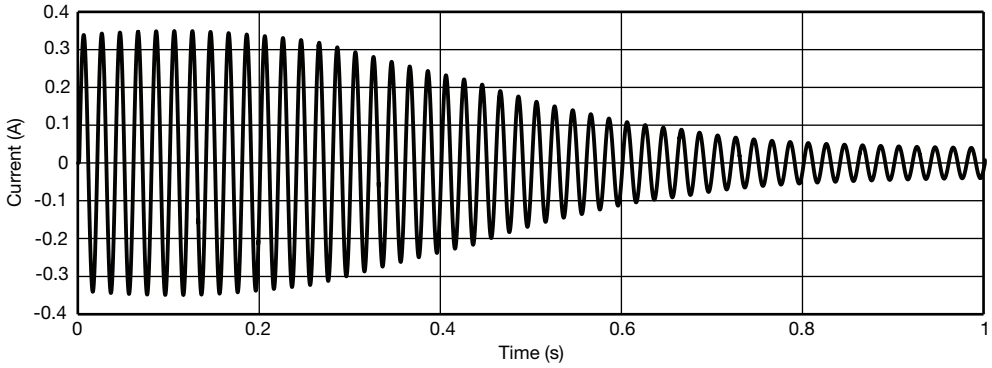


Fig. 6 - Current in PTCSL03T121