

Temperature Stability and Repeatability of High-Precision Trimming Resistors



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Bulk Metal® Foil high-precision trimmer resistors from Vishay Foil Resistors are evaluated with a millimeter wave variable attenuator. The resistors are used to precisely set the control voltage of the attenuator. The test is carried out at different temperatures between -25 °C and +75 °C. The results show the excellent temperature stability, tuning precision, and settling property of the trimmer resistors.

Company/Institute: Poly-Grames Research Center

Industry/Application Area: RF front end system

Product Used: [1 kΩ Accutrim™ 1240 Bulk Metal Foil trimming resistor](#)
(global part number: Y40531K00000J0L)

The Challenge

These resistor products are mounted close to a power amplifier that generates high heat. On the other hand, the end product needs to work at an ambient temperature from -30 °C to +40 °C. Low temperature coefficient and a quick setting/trimming are required by the application.

The Solution

By using the high-quality Bulk Metal Foil Accutrim resistor, we achieve excellent temperature stability and tuning repeatability.

The User Explains

The AMMP-6640 variable attenuator from Avago Technologies is controlled by two pins: V_{SE} and V_{SH} (Figure 1). They are fed by a DC voltage between 0 V and 1.2 V. In the test, the voltage is set by using Vishay Foil Resistors Accutrim 1240 Bulk Metal Foil high-precision trimming resistors. The set-up (as shown in Figures 2 and 5) is used to characterize the precision and temperature stability of the resistors.



Keysight's PNA-X N5247A network analyzer is used for measuring the RF performance (S-parameter); HP 3457A multi-meters measure the voltage on the control pins; an Agilent E3648A power supply provides DC feeding; an Anritsu 3680V universal test fixture is used as the RF interface; and a TestEquity Half Cube temperature chamber controls the temperature. Under each of the temperature conditions (-25 °C to +75 °C), the attenuation value is set by tuning the two trimming resistors. The data is collected as shown in Figures 6 and 8.

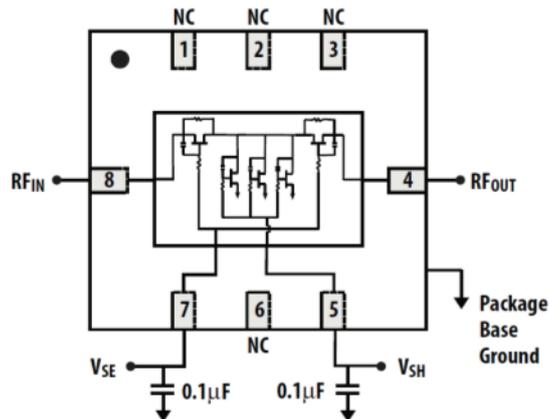


Fig.1 — Schematic of the AMMP-6640 chip

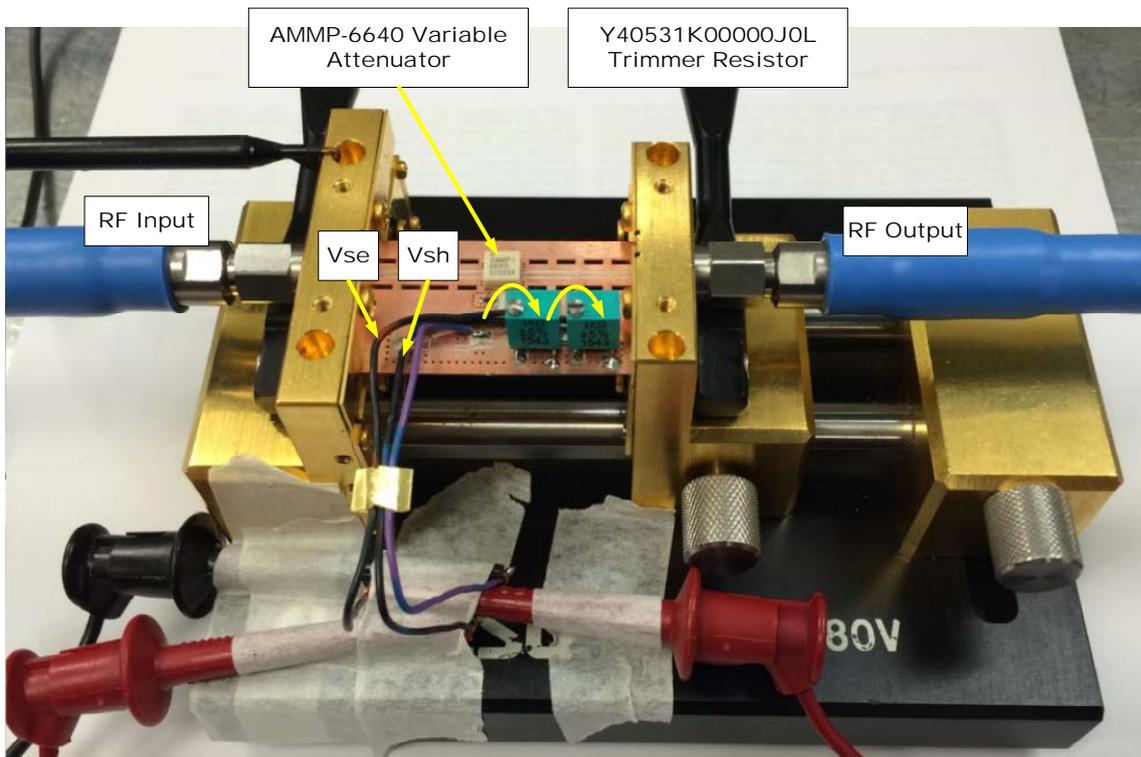


Fig.2 — Test circuit in fixture



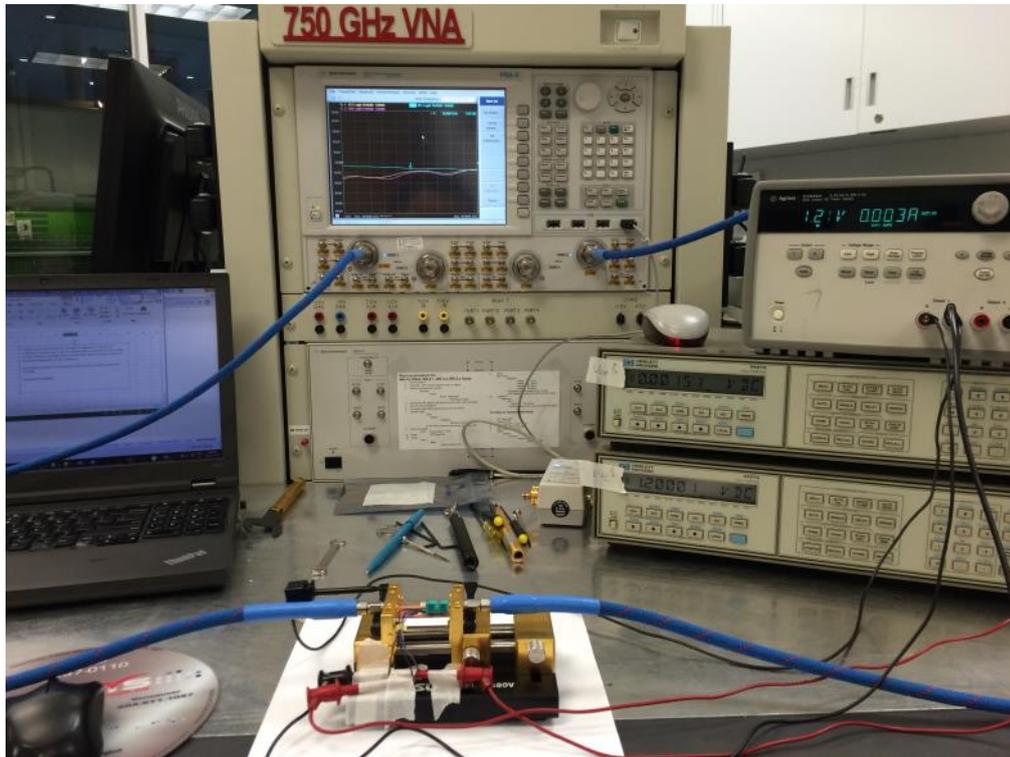


Fig.3 — Test setup



Fig.4 — Inside of the temperature chamber





Fig.5 — Outside of the temperature chamber

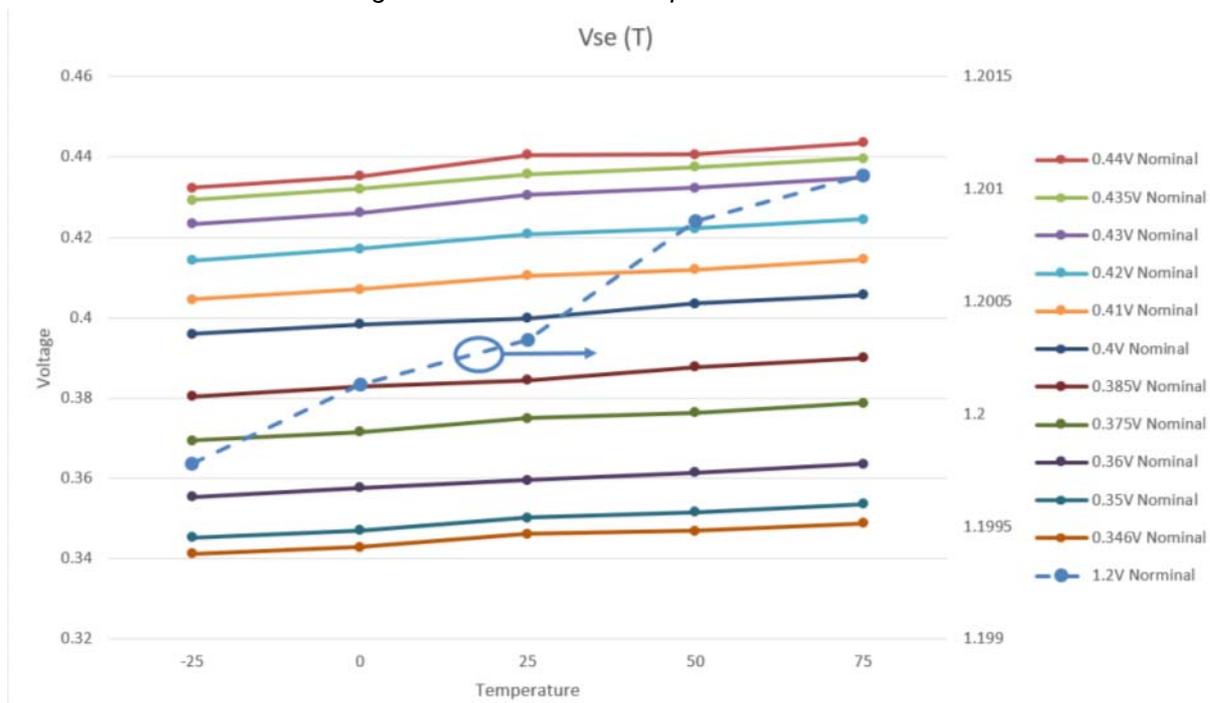


Fig.6 — Voltage of V_{SE} pin versus temperature



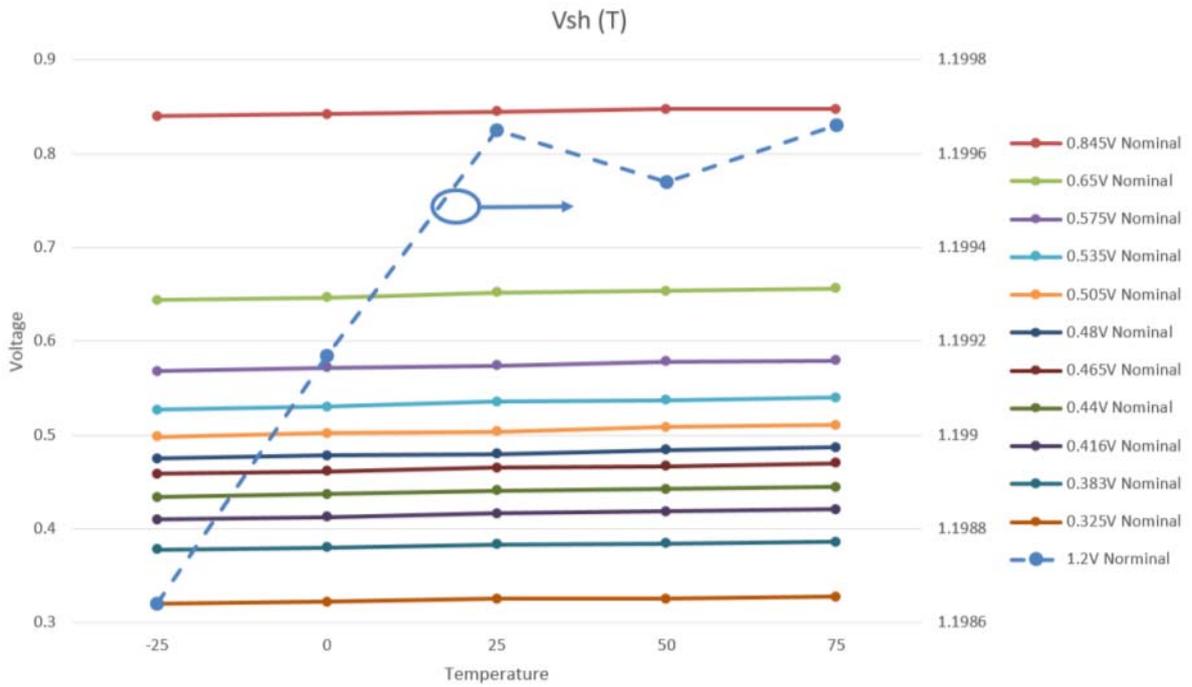


Fig.7 — Voltage of V_{SH} pin versus temperature

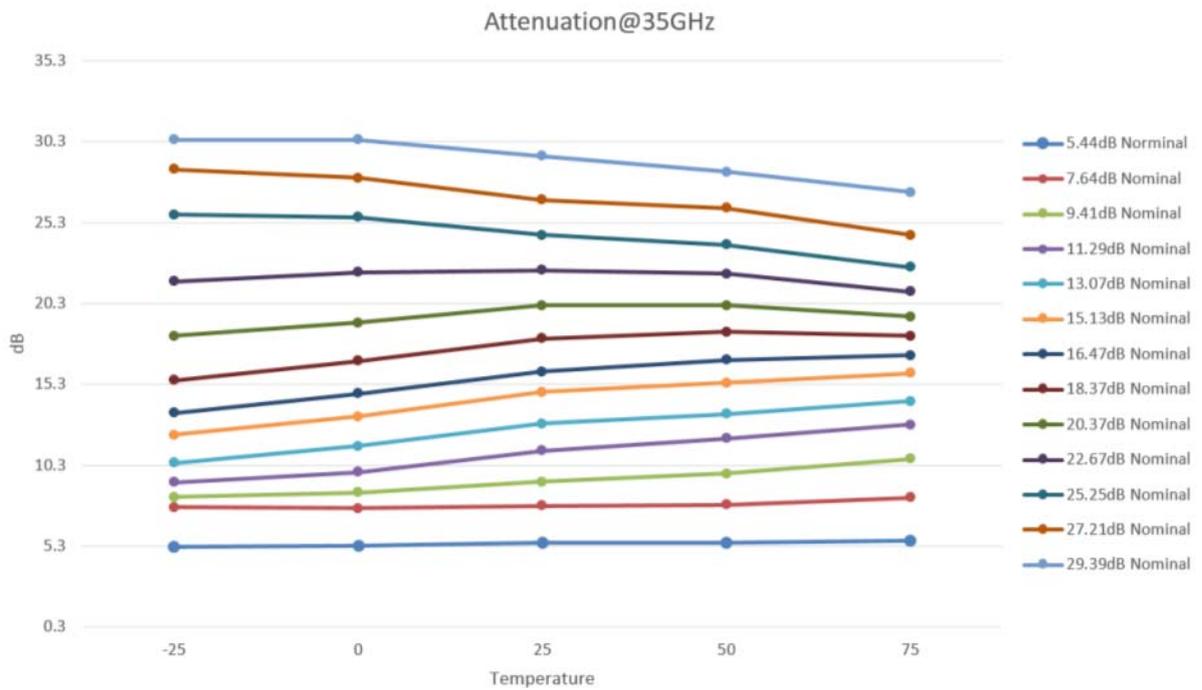


Fig.8 — Attenuation versus temperature



“Tuning of the evaluated product is easy, the change of resistance is smooth, and it's very easy to set the voltage with accuracy of <0.1 %. Unlike normal trimmers, the slight force applied on the screw when trimming it doesn't have a detectable impact on the resistance value. By using this trimmer, the attenuation value can be set with an accuracy of <0.05 dB. As seen from the figures, the temperature stability is excellent.”

Acknowledgement:

The Poly-Grames Research Center of Polytechnique de Montreal has a long history of excellence in research and education of radio-frequency (RF), microwave, millimeter-wave, and microwave photonics engineering. This is one of the largest and leading international academic research institutions in the field with three Canada Research Chairs (CRC) endowed by the Canadian government. In 2012, the center hosted the International Microwave Symposium, the largest RF and microwave conference in the world.

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