Application Note: AN0003
Thermopad® Amplifier Temperature Compensation

The Thermopad is an absorptive microwave attenuator which provides power dissipation that varies with temperature. It is extremely useful as a temperature compensating element. For example, a very common problem with GaAs amplifiers is that the gain of the amplifier varies by -0.001 dB/°C for every dB of gain. So, a 30 dB amplifier would have a gain coefficient of -0.03 dB/°C. The gain of the amplifier can be stabilized over temperature by cascading it with a 6 dB Thermopad with a -0.03 dB/°C temperature coefficient (see **Figure 1**). Also shown in the figure is the amplifier response using the conventional compensation of a PIN diode variable attenuator with DC coupling for bias application, a driver circuit with linear compensation, and a temperature probe. The latter method is more costly, in terms of material, board space, and assembly time; it is less reliable and can produce RF distortion.

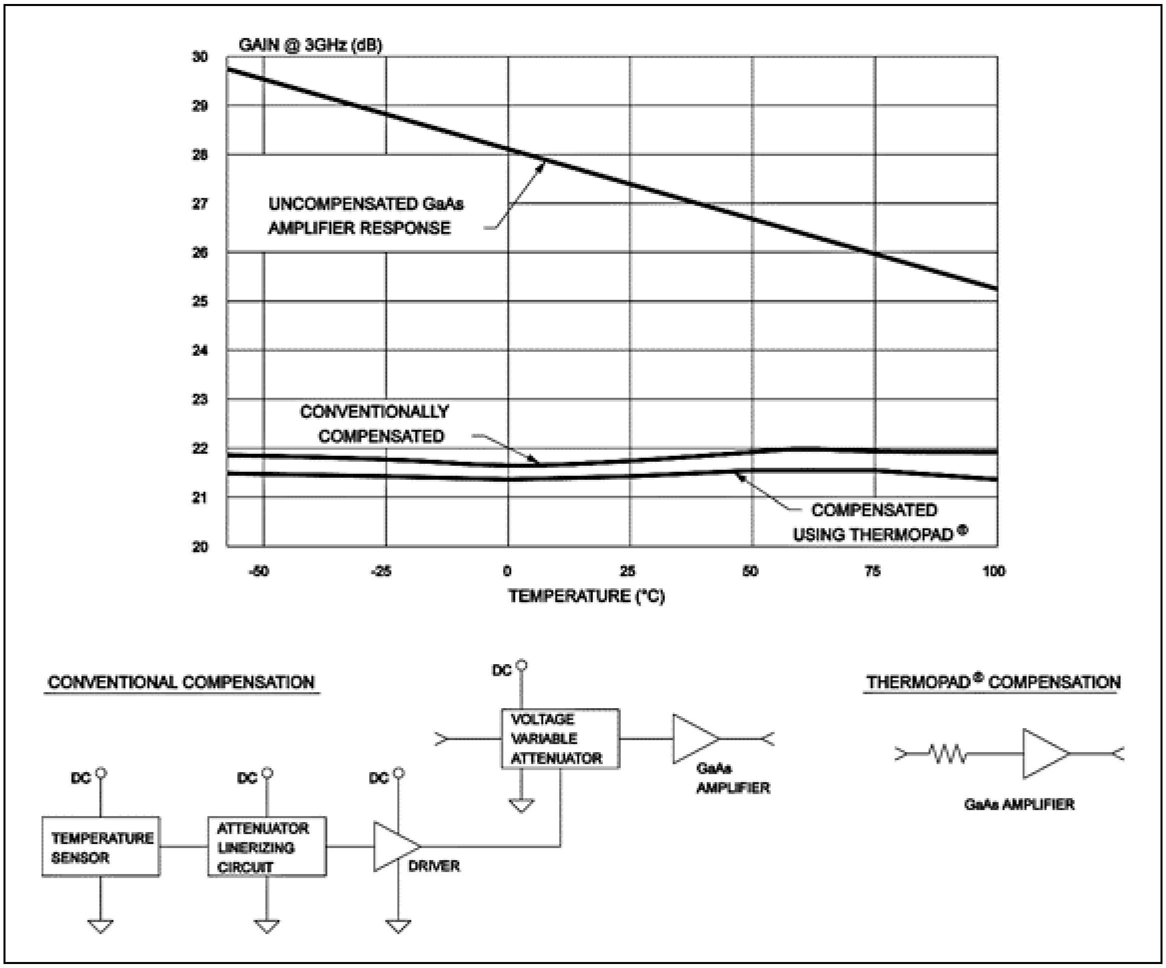

Figure 1

Application Note: AN0004
Thermopad® Attenuation Shift Due to Self-Heating

Attenuation shift due to self-heating is not a consideration for low power applications. However, when you design circuits using the Thermopad®, it is important to provide proper heat dissipation. The attenuation of the Thermopad® will vary with the temperature of the component's resistive film. As the power input to the Thermopad is increased, the film temperature increases. In order to achieve the desired performance, you must know the Thermopad® film temperature. The film temperature can be calculated by:

Tf = Pd/Cth + Ths(°C)

where:

Pd = power dissipated (W)
Ths = heat sink temperature (°C)
Cth = thermal conductivity of the Thermopad® (W/°C)

The Thermopad® may be operated at rated power when mounted on a heat sink maintained at 25°C. The input power should be de-rated linearly to zero at 150°C. If a good thermal connection is made between the heat sink and the Thermopad® using thermally conductive epoxy or thermal grease, you may use the following thermal conductances to calculate the film temperature:

TVA series:	0.2 W/°C
CTVA series:	0.2 W/°C
MTVA series:	0.05 W/°C
HTVA series:	0.05 W/°C
WTVA series:	0.05 W/°C
KTVA series:	0.05 W/°C
AN3 series:	0.2 W/°C
AN5 series:	0.05 W/°C
AN7 series:	0.05 W/°C

For example, the temperature rise across an MTVA0300N05 from nominal temperature (25°C) at the maximum rated power of 0.2W will be:

T_f = 0.2W/0.05W + 25°C = 29°C

The resulting attenuation shift caused by self-heating will be -0.06 dB. Even when operated at full rated power, attenuation shift of the Thermopad® due to self-heating is minimal.