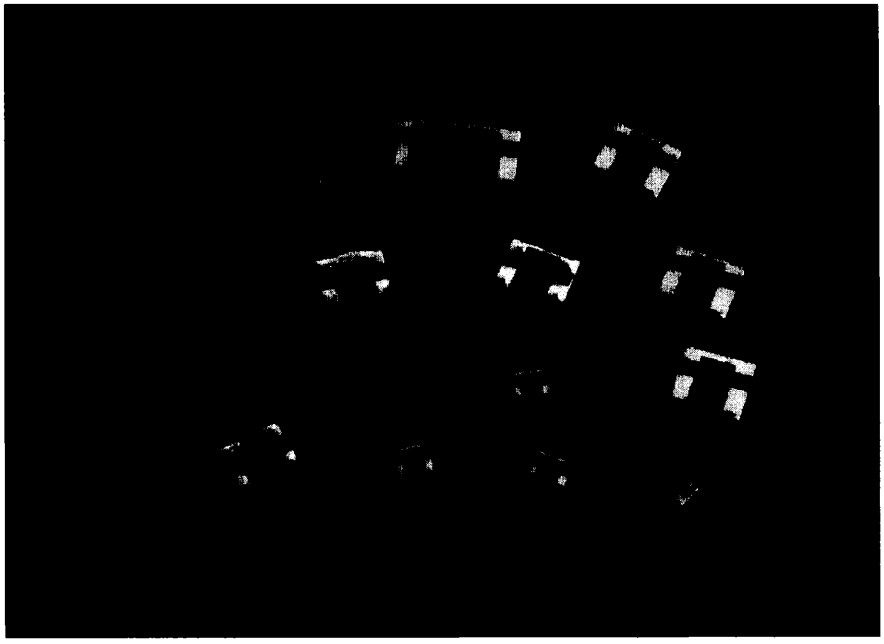
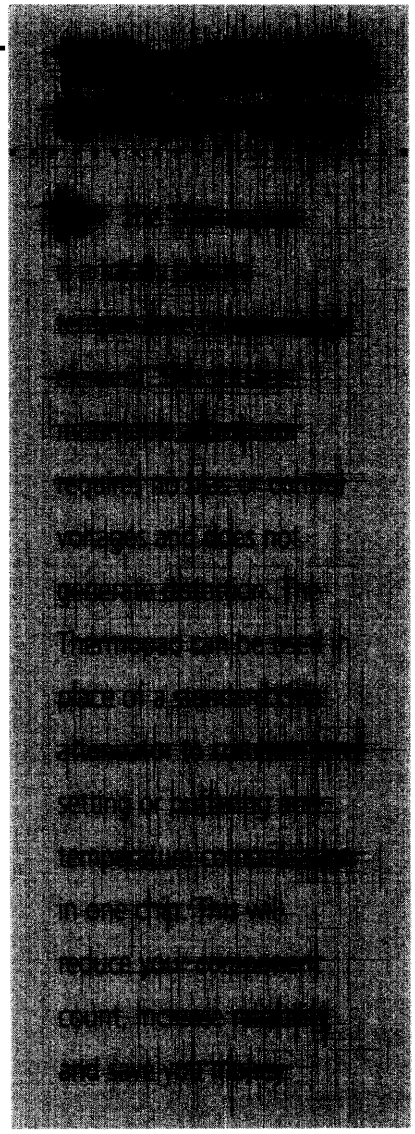
THERMOPAD® TEMPERATURE COMPENSATING ATTENUATOR





THERMOPAD TEMPERATURE COMPENSATING ATTENUATOR

The Thermopad is a patented (U.S. Patent # 5,332,981), absorptive microwave attenuator which provides power dissipation that varies with temperature. The device can be used in any application that requires a known amount of attenuation change for a particular temperature shift. This is particularly useful for maintaining the output of gain stages, mixers, power dividers, and other signal processing components over temperature.

In applications from DC - 18 GHz, EMC's Thermopad is the ideal temperature compensation solution for cost, performance, and reliability. The Thermopad can replace closed loop temperature compensation circuits with a single chip device requiring no bias or control. It excels in multiple signal applications such as cellular telephone and PCN because of its low cost and because it produces no signal distortion. In high reliability, military, and spacecraft applications, the Thermopad reduces system complexity and cost while improving overall reliability. The Thermopad is available in a wide variety of package styles. All styles are available on tape and reel packaging.

THERMOPAD® TEMPERATURE COMPENSATING ATTENUATOR

SPECIFICATIONS:

Frequency Range:	DC - 6 GHz, TVA and DTVA Series DC - 18 GHz, MTVA Series
Attenuation Accuracy:	± 0.5 dB or 5%, whichever is greater at 1 GHz
TCA Tolerance:	± 0.001 dB/dB/°C
VSWR:	1.30 maximum at 1 GHz
Operating Temperature:	-55°C to +150°C
Substrate:	Alumina
Termination Material:	Platinum gold, thick film
Resistive Element:	Thick film

NOTES:

- Performance is based on device mounted in a matched 50Ω line and is highly dependent on device mounting. See Application Note 003 on page 81.
- Rated input power is 2 watts for TVA and DTVA Series and 0.2 watts for MTVA Series chips. Maximum peak input power is 50 watts for TVA and DTVA Series and 1 watt for MTVA Series chips. Duty cycle is 1% with a pulse width of 10 microseconds.
- Full rated power to 125°C, derate linearly to 0 watts at 150°C.

SELECTION GUIDE:

- Determine polarity and the amount of compensation required by your circuit.
- Refer to the "Thermopad Temperature Shift Cross Reference" chart on the next page to select the minimum room temperature attenuation and temperature coefficient of attenuation (TCA) which yields the required compensation. The available configurations are listed by type in the "Available Configuration of Thermopad" chart on the next page.
- Determine the part number as shown in the example on page 21.

THERMOPAD® TEMPERATURE COMPENSATING ATTENUATOR

THERMOPAD® TEMPERATURE SHIFT CROSS REFERENCE CHART (ATTENUATION SHIFT IN dB PER 10°C)

TCA*	Attenuation at 25°C									
dB/dB°C	1 dB	2 dB	3 dB	4 dB	5 dB	6 dB	7 dB	8 dB	9 dB	10 dB
-0.003	-0.03	-0.06	-0.09	-0.12	-0.15	-0.18	-0.21	-0.24	-	-0.30
-0.004	-	-0.08	-0.12	-0.16	-0.20	-0.24	-0.28	-0.32	-	-0.40
-0.005	-0.05	-0.10	-0.15	-0.20	-0.25	-0.30	-0.35	-	-	-0.50
-0.006	-	-0.12	-0.18	-0.24	-0.30	-0.36	-0.42	-	-	-0.60
-0.007	-0.07	-0.14	-0.21	-0.28	-0.35	-0.42	-0.49	-0.56	-0.63	-0.70
+0.003	+0.03	-	+0.09	-	-	+0.18	-	-	-	-
+0.005	+0.05	-	+0.15	-	-	+0.30	-	-	-	-
+0.006	+0.06	-	-	-	-	-	-	-	-	-
+0.007	+0.07	+0.14	+0.21	-	-	+0.42	-	-	-	-

**TCA = Temperature Coefficient of Attenuation*

AVAILABLE CONFIGURATION OF THERMOPAD

Temperature Coefficient Code	TCA* dB/dB°C	Attenuation at 25°C									
		1 dB	2 dB	3 dB	4 dB	5 dB	6 dB	7 dB	8 dB	9 dB	10 dB
N03	-0.003	T	M,T	M,T	M,T	M,T	M,T	T	T	-	T
N04	-0.004	-	M	M,T	T	T	M,T	T	DT	-	DT
N05	-0.005	T	M,T	**M**,T	M,T	M,T	M,T	T	-	-	DT
N06	-0.006	-	T	T	T	T	T	T	-	-	DT
N07	-0.007	T	T	**T**	**T**	**T**	**T**	T	DT	DT	DT
P03	+0.003	T	-	T	-	-	T	-	-	-	-
P05	+0.005	T	-	T	-	-	T	-	-	-	-
P06	+0.006	T	-	-	-	-	-	-	-	-	-
P07	+0.007	T	T	T	-	-	T	-	-	-	-

The configurations most popular with designers are indicated in blue.
** TCA = Temperature Coefficient of Attenuation.*

T = TVA series chips
DT = DTVA series chips
M = MTVA series chips

▶ See drawings on the following pages.

THERMOPAD® TEMPERATURE COMPENSATING ATTENUATOR

ORDERING INFORMATION

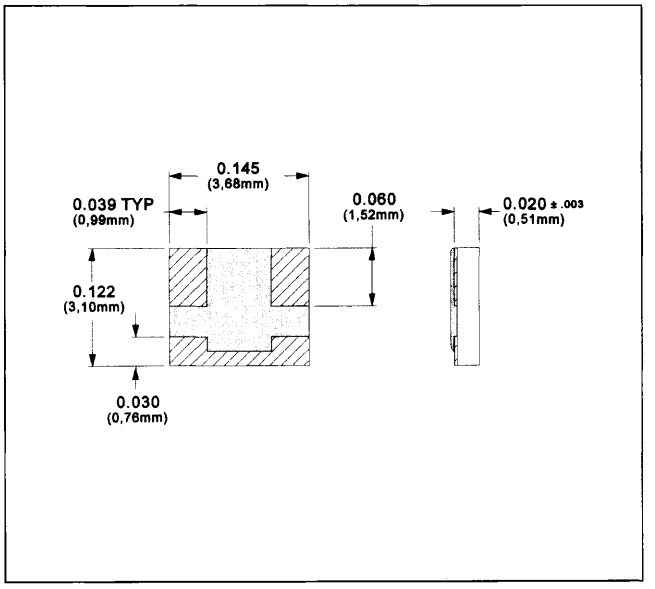
METALLIZATION OPTIONS

- **Planar (no code)** Planar device for flip chip mounting offers the best RF performance and lowest cost.
- **Triple Wrap (W3)** Metallization wraps around input, output, and ground terminals. Permits inspectable solder fillets when flip chip mounting. See Application Note 006 on page 88.
- **Single Wrap (W1)** Metallization wraps around ground terminal only. Full backside metallization.
- **Pretinned (S)** Pretinning improves solderability (available on all of the above options).
- **Single Wrap (WB1) (MTVA series only)** Metallization wraps around ground terminal only. Full backside metallization. Input (MTVA series only) and output terminals have gold metallization.
- **Gold (G) (MTVA series only)** Planar device with gold metallization. Typically used for wirebonding.

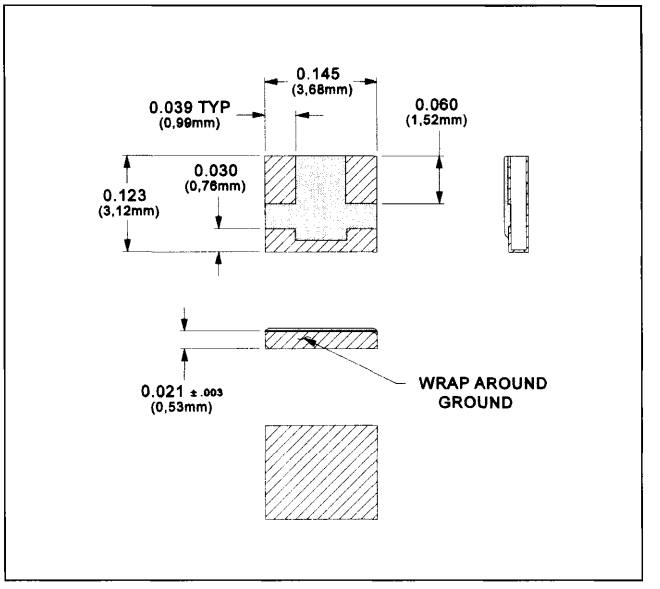
Configuration Code	Attenuation Value	Temperature Coefficient Code	Metallization Option	Pretinning
TVA DTVA MTVA				
XXXX	XXOO	XXX	XXX	X

Example: P/N TVA0300N07 = TVA configuration, 3 dB nominal, negative shift, .007 temperature coefficient

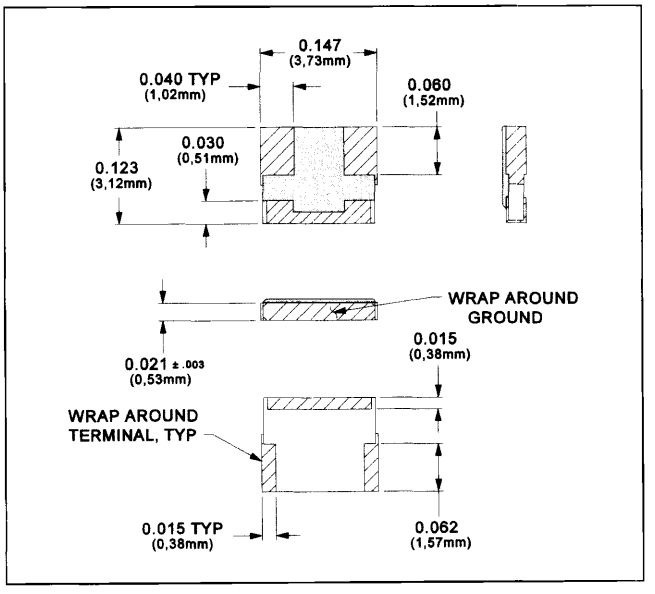
THERMOPAD® TEMPERATURE COMPENSATING ATTENUATOR



TVA Planar Configuration



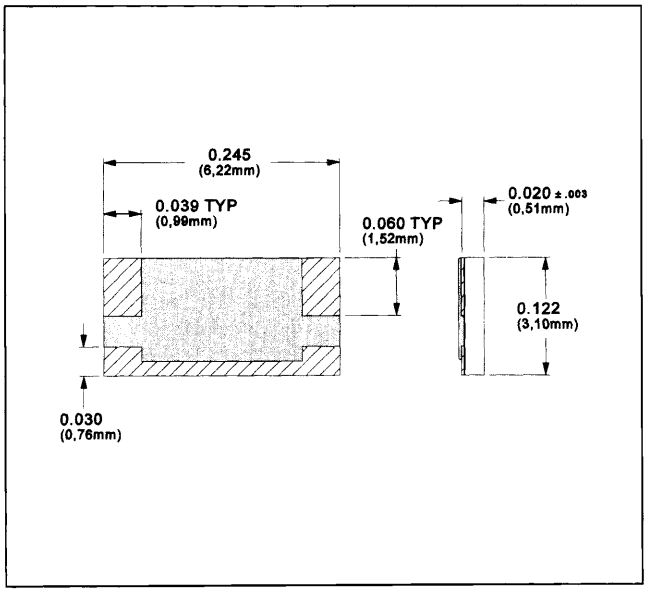
TVA W1 Configuration



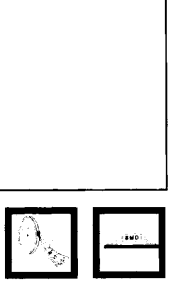
TVA W3 Configuration

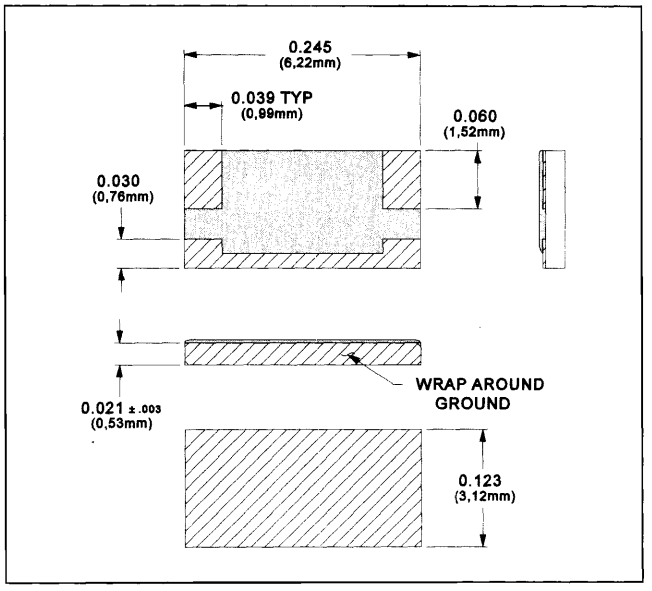
▶ See Application Note 003 on page 81.

THERMOPAD® TEMPERATURE COMPENSATING ATTENUATOR

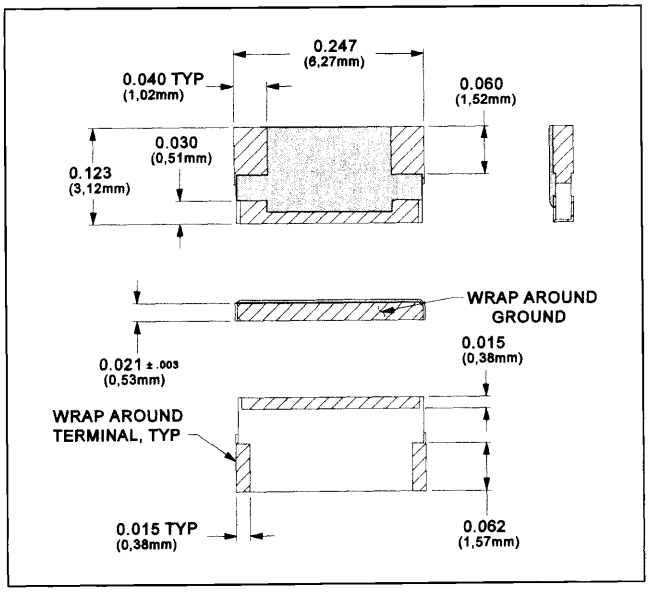


DTVA Planar Configuration





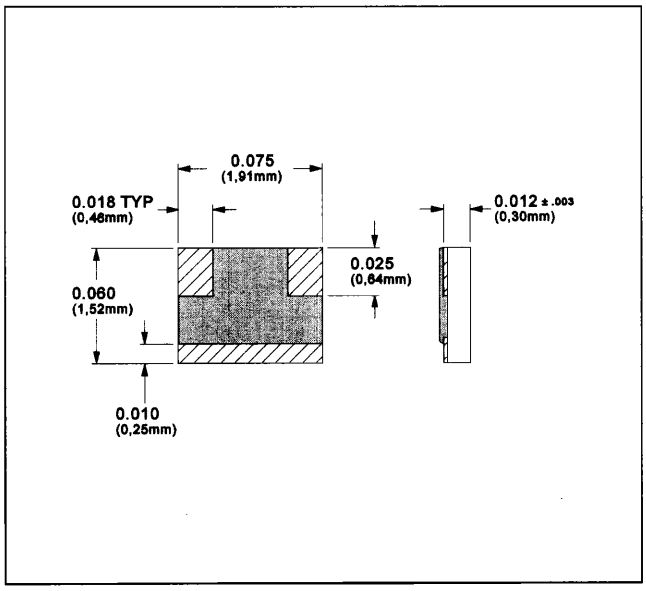
DTVA W1 Configuration



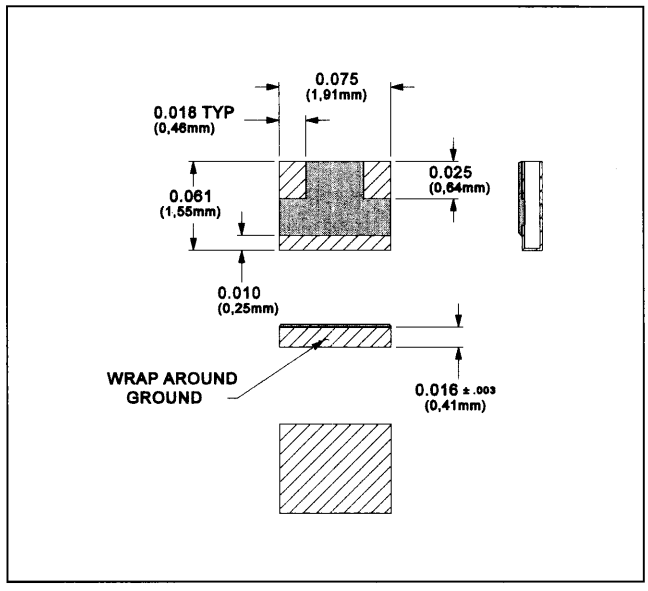
DTVA W3 Configuration

▶ See Application Note 003 on page 81.

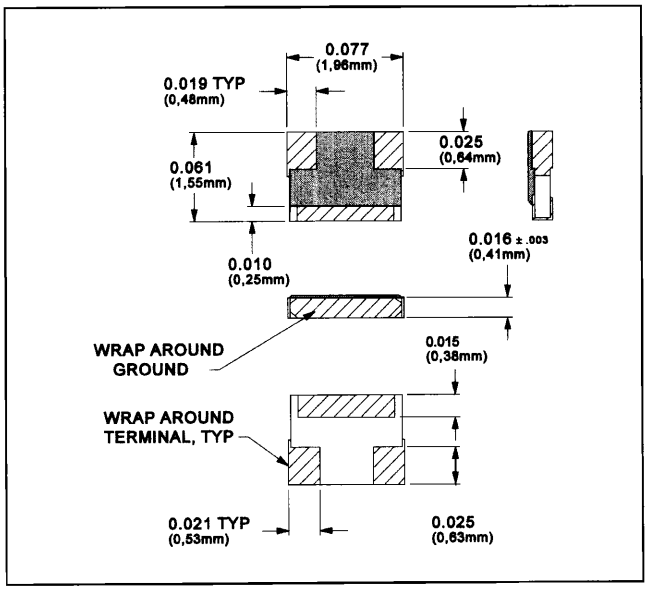
THERMOPAD® TEMPERATURE COMPENSATING ATTENUATOR



MTVA Planar Configuration



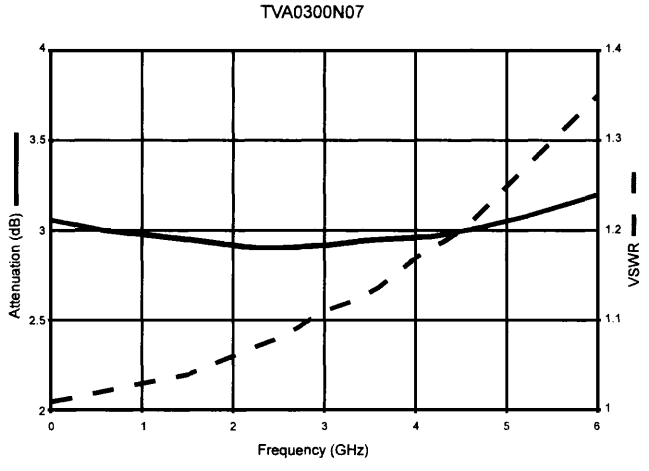
MTVA W1/WB1 Configuration



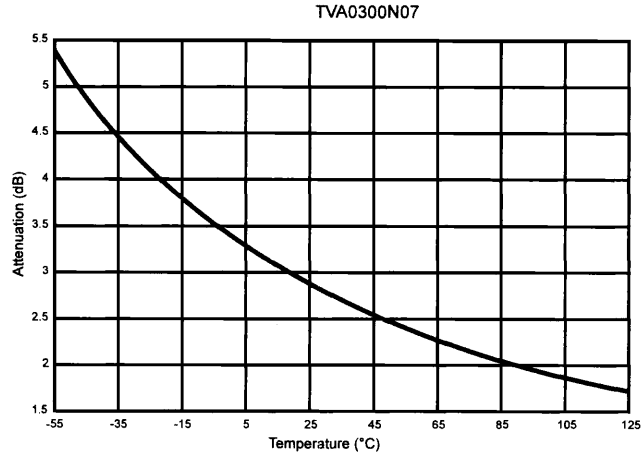
MTVA W3 Configuration

▶ See Application Note 003 on page 81.

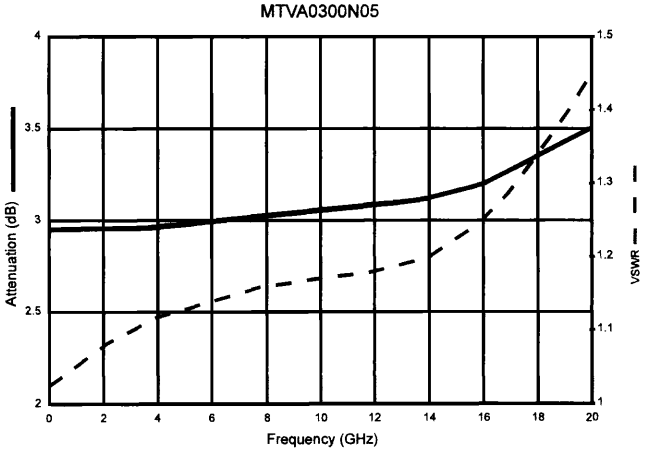
THERMOPAD® TEMPERATURE COMPENSATING ATTENUATOR



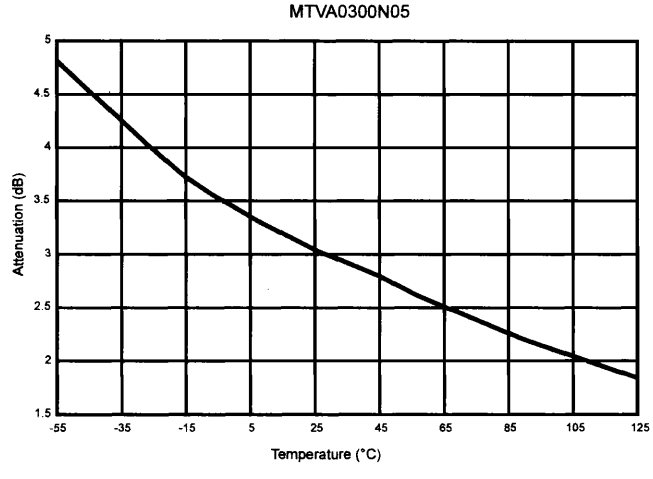
Typical Thermopad® RF Performance
TVA0300N07



Thermopad® Temperature vs. Attenuation for
TVA0300N07



Typical Thermopad® RF Performance
MTVA0300N05



Thermopad® Temperature vs. Attenuation for
MTVA0300N05