



5-Bit Digital Attenuator

2.0-20.0 GHz

Preliminary Information

MAATGM0004-DIE

Features

- ◆ 5-Bit Attenuator, 23 dB Range, LSB = 0.75 dB
- ◆ 2.0 to 20.0 GHz Operation
- ◆ TTL Control Inputs
- ◆ Self-Aligned MSAG[®] MESFET Process

Primary Applications

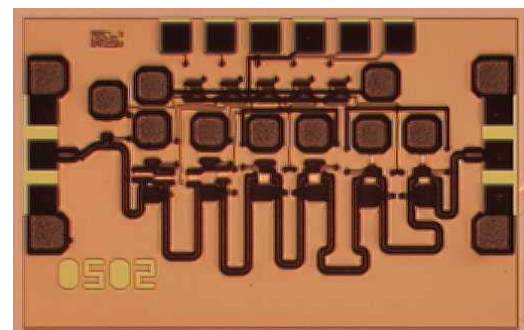
- ◆ VSAT
- ◆ Point to Point Communications
- ◆ Weather Radar
- ◆ Military Radar
- ◆ Electronic Warfare

Description

The MAATGM0004-Die is a 5-bit Digital Attenuator with Parallel Input Control. This product is fully matched to 50 ohms on both the input and output.

Each device is 100% RF tested on wafer to ensure performance compliance. The part is fabricated using M/A-COM's repeatable, high performance and highly reliable GaAs Multifunction Self-Aligned Gate (MSAG[®])

2.0-20.0 GHz GaAs MMIC Attenuator



Electrical Characteristics: $T_B = 40^\circ\text{C}^1$, $Z_0 = 50\Omega$, $V_{EE} = -5\text{V}$

Parameter	Symbol	Typical	Units
Bandwidth	f	2.0-20.0	GHz
Insertion Loss @ 10 GHz, Reference State	IL	4.0	dB
Insertion Loss @ 20 GHz, Reference State	IL	5.0	dB
Input VSWR, All States	VSWR	1.4:1	
Output VSWR, All States	VSWR	1.4:1	
RMS Attenuation Error	α_{RMS}	< 1.0	dB
RMS Attenuation Error, Calibrated	α_{RMS}	< 0.4	dB
Attenuation Range	ΔG	23	°
Phase Variation over all Attenuation States @ 20 GHz	$\Delta\Phi$	-13 to 21	°
Current	I_{EE}	5	mA
Input Third Order Intercept	ITOI	32	dBm
Input 1-dB Compression Point	$P_{1\text{dB}}$	26	dBm

Maximum Operating Conditions ¹

Parameter	Symbol	Absolute Maximum	Units
Input Power	P_{IN}	31	dBm
Source Supply Voltage	V_{EE}	-6.0	V
Junction Temperature	T_J	180	°C
Storage Temperature	T_{STG}	-55 to +150	°C

1. Operation outside of these ranges may reduce product reliability. Operation at other than the typical values may result in performance outside the guaranteed limits.

Recommended Operating Conditions

Characteristic	Symbol	Min	Typ	Max	Unit
Source Voltage	V_{EE}	-5.2	-5	-4.8	V
Control Voltage	$V_{\text{control pads}}$				
Logic High		3	5	5	V
Logic Low		0	0	0.4	V

Operating Instructions

This device is static and light sensitive. Digital circuit operation can be impaired under high intensity light, e.g. microscope light. Please handle with care. To operate the device, follow these steps.

1. Power Up: Apply $V_{EE} = -5$ V.
2. Apply Logic Voltages to control Circuits as listed in Recommended Operating Conditions
3. Power Down: Set $V_{EE} = 0$



Specifications subject to change without notice.

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Email: macom_adbu_ics@tycoelectronics.com

- **North America:** Tel. (800) 366-2266
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2 to 20 GHz Digital Attenuator

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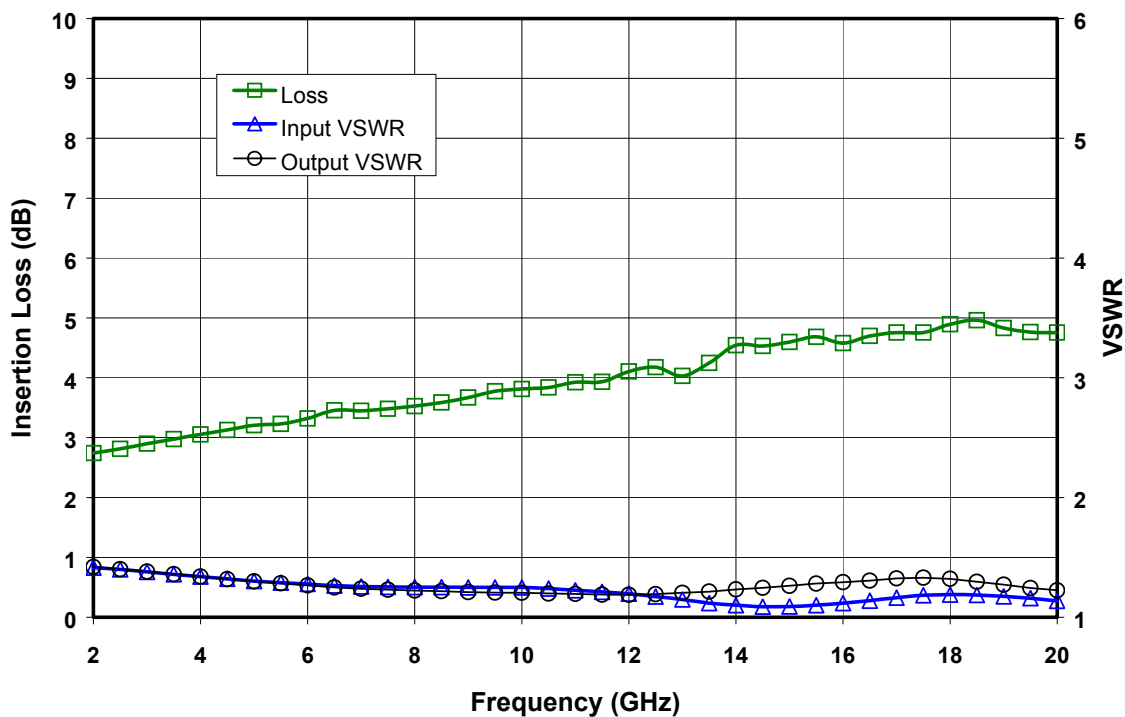


Figure 1. Reference State Insertion Loss, Input and Output VSWR vs. Frequency

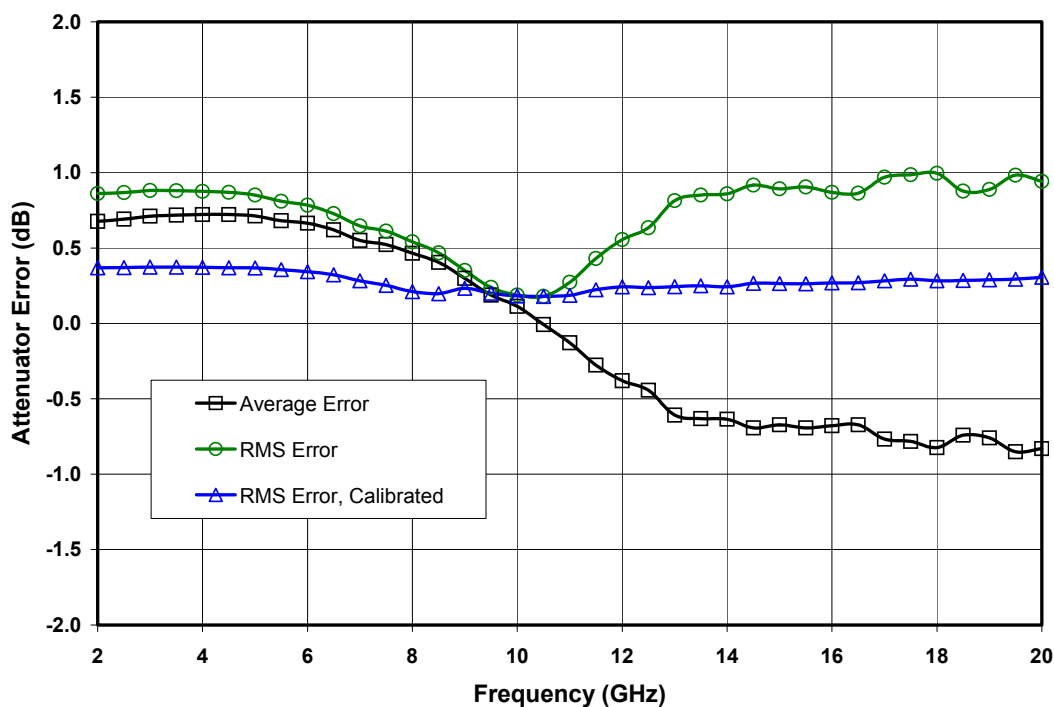


Figure 2. Attenuator Figures of Merit: Average Error vs Ref State, RMS Error and Calibrated RMS Error over All States

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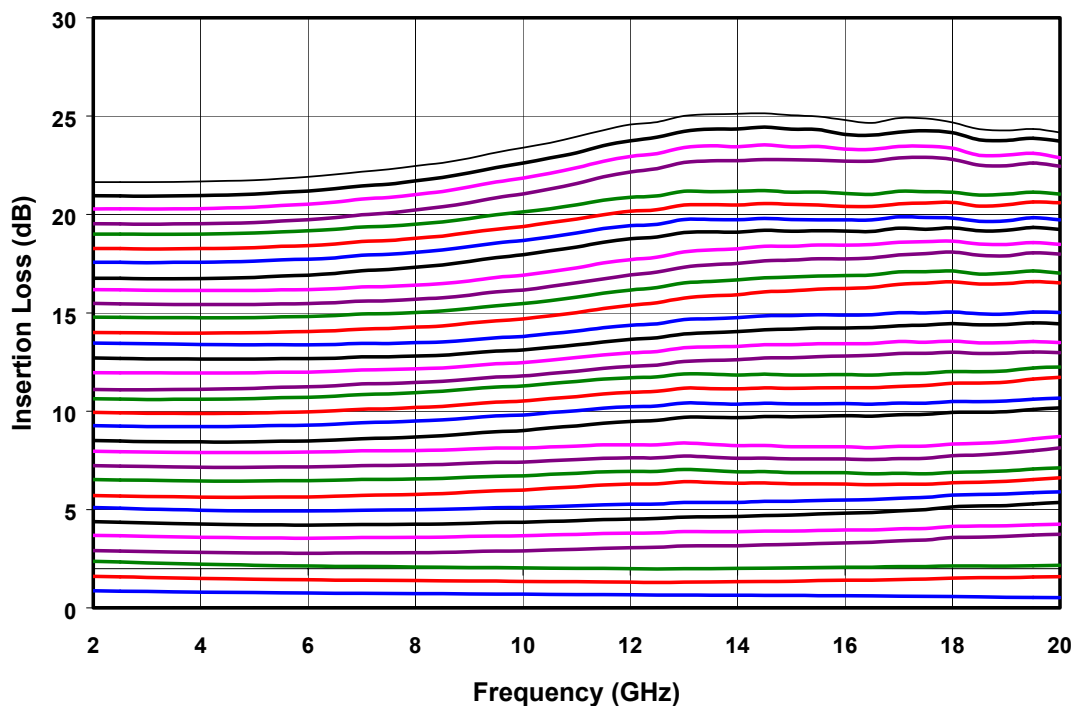


Figure 3. Insertion Loss vs Attenuator State

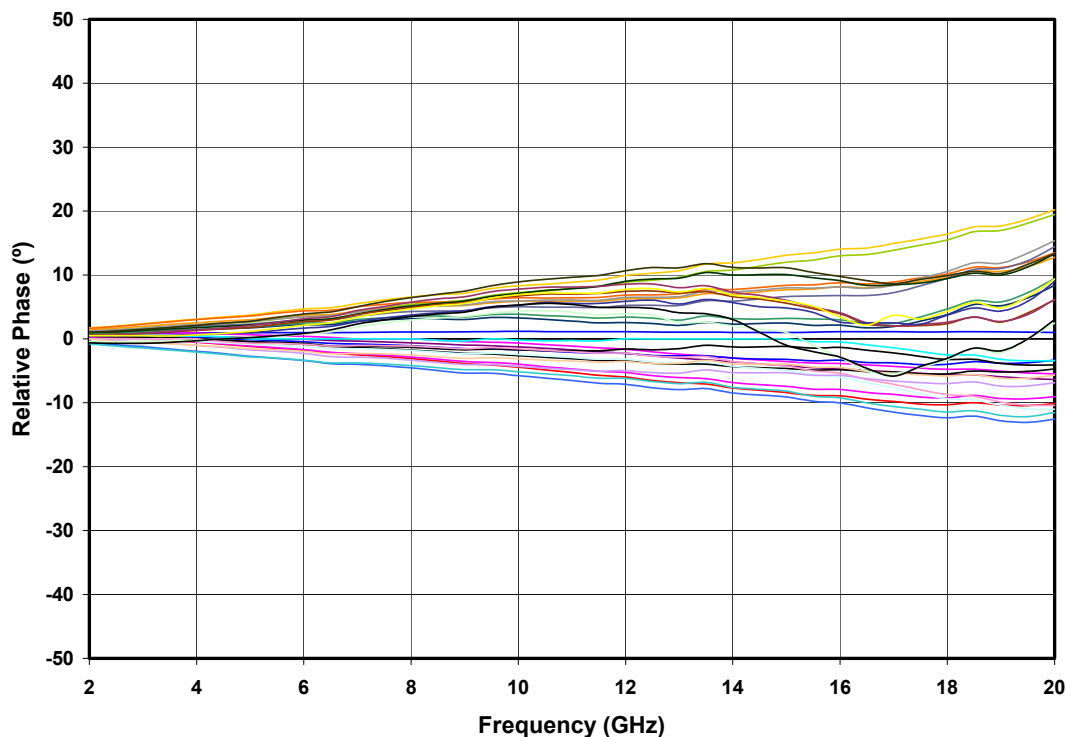


Figure 4. Relative Phase Change vs Attenuator State

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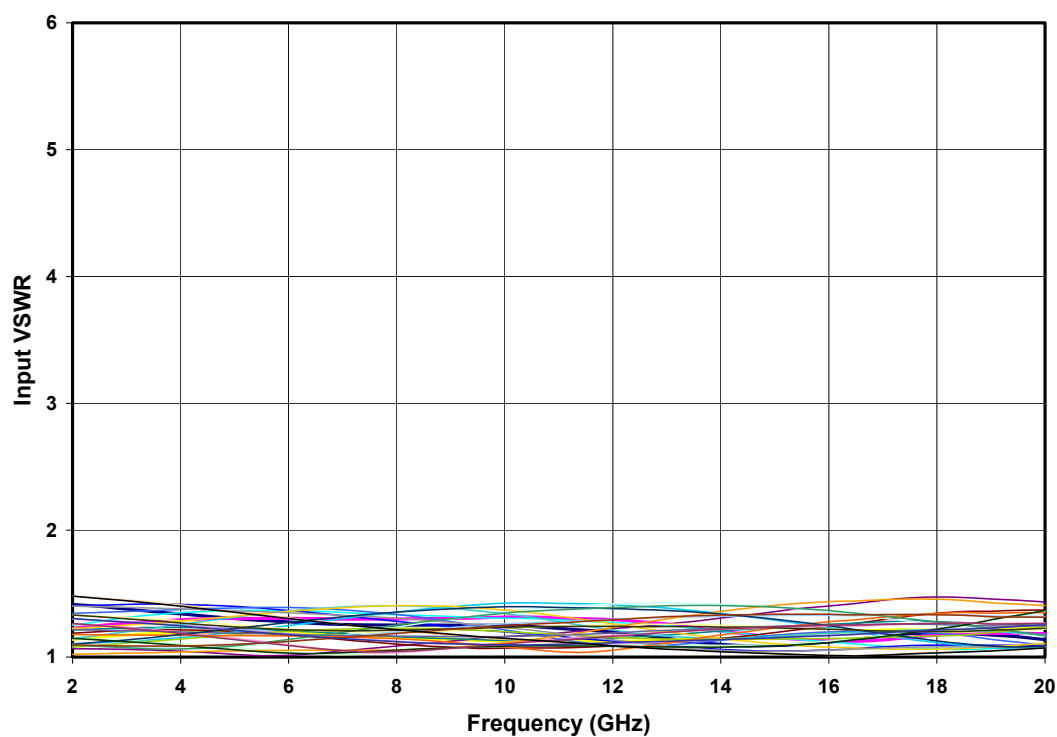


Figure 5. Input VSWR vs. Attenuator State

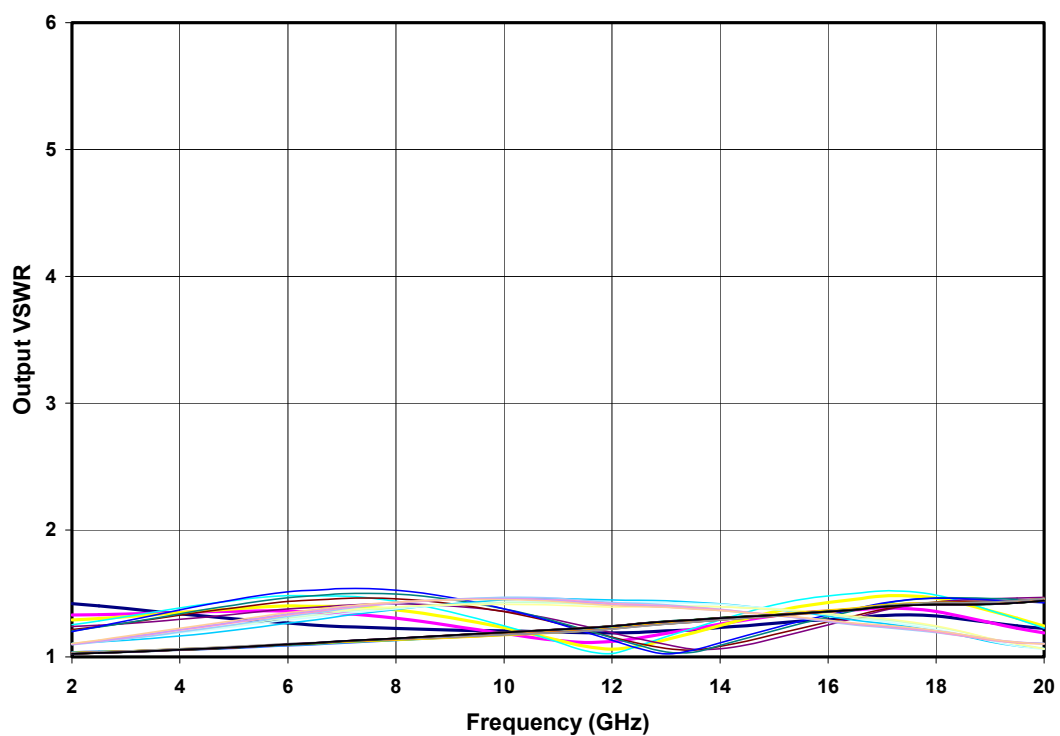


Figure 6. Output VSWR vs. Attenuator State

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Mechanical Information

Chip Size: 2.326 x 1.500 x 0.075 mm (92 x 59 x 3 mils)

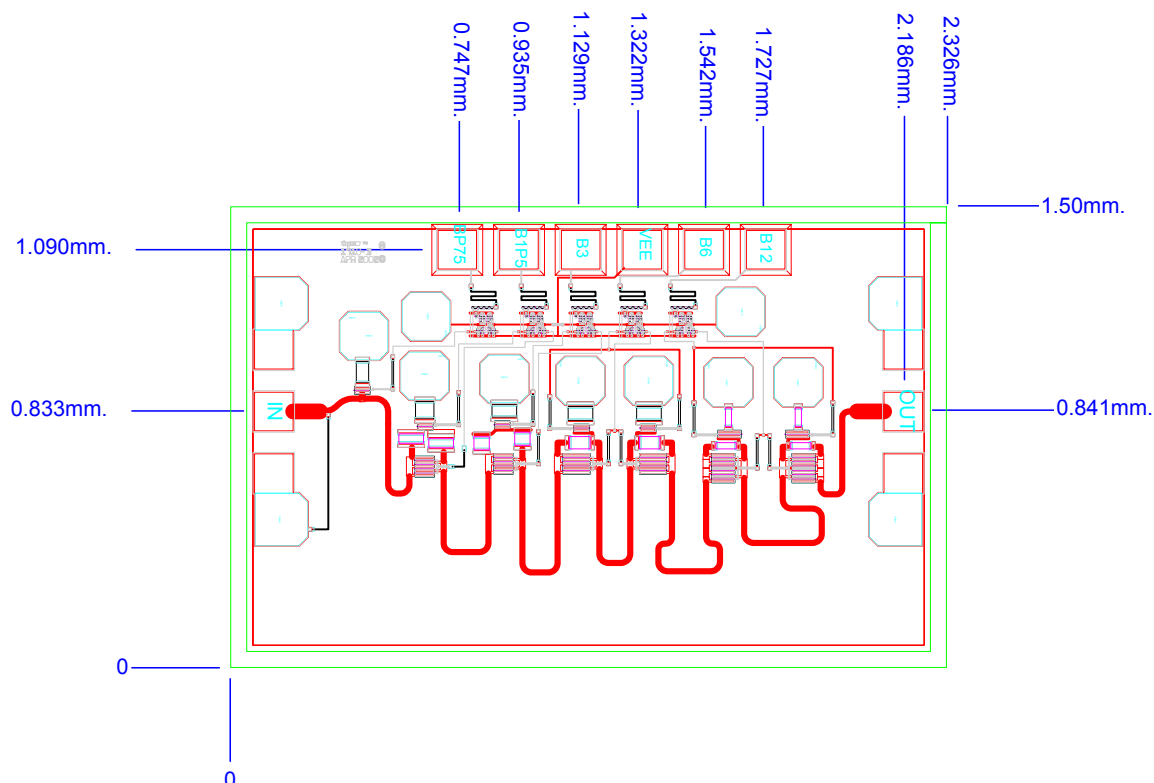


Figure 7. Die Layout

Bond Pad Dimensions

Pad	Size (μm)	Size (mils)
RF In and Out	100 x 200	4 x 8
DC Supply Voltage VEE	125 x 125	5 x 5
DC Control Voltage VC	125 x 125	5 x 5

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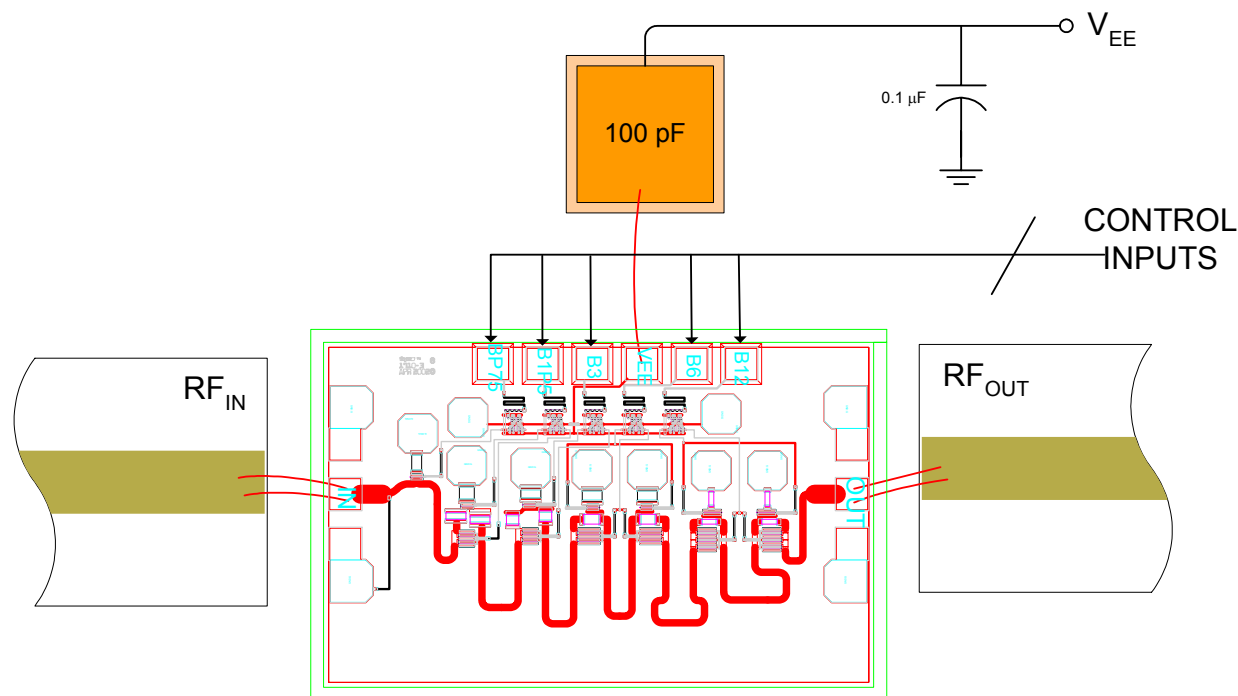


Figure 8. Recommended bonding diagram for pedestal mount.
Support circuitry typical of MMIC characterization.

Assembly Instructions:

Die attach: Low thermal conductivity silver epoxies are acceptable for die attach of this MMIC. Follow the manufacturer's instructions. If solder is employed, use AuSn (80/20) 1-2 mil preform solder. Limit time @ 300 °C to less than 5 minutes.

Wirebonding: Bond @ 160 °C using standard ball or thermal compression wedge bond techniques. For DC and RF pad connections, use either ball or wedge bonds. For best performance, especially above 10 GHz, wedge bonds of shortest length employed on the RF interconnects is preferred over ball bonds.

Biasing Note: Must apply negative bias to V_{EE} before applying positive bias to Control Pads.

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