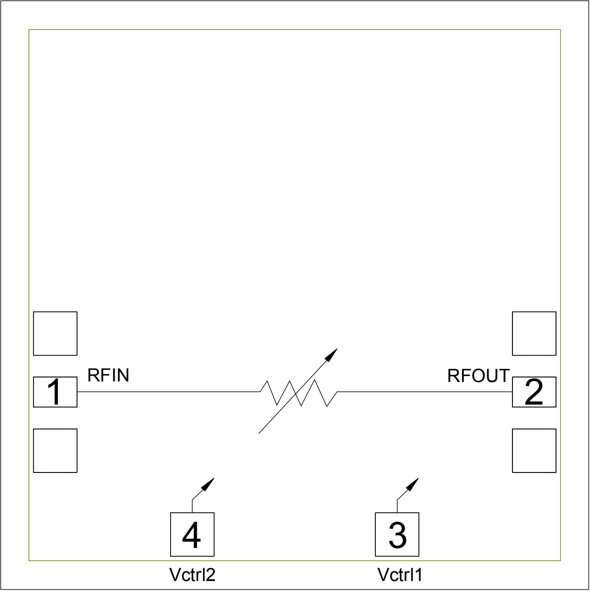
CMD172

18-40 GHz Voltage-Variable Attenuator

Features

- ► Ultra wideband performance
- ► Low insertion loss
- ► Wide attenuation range
- ► Small die size

Functional Block Diagram



Description

The CMD172 is wideband GaAs MMIC absorptive Voltage-Variable Attenuator (VVA) die which operates from 18 to 40 GHz. The VVA uses a single DC control voltage of -3V to 0V to control RF signal levels over a 37 dB dynamic range. The CMD172 has an extremely low insertion loss of 1.6 dB and is a 50 ohm matched design which eliminates the need for RF port matching. The CMD172 offers full passivation for increased reliability and moisture protection.

Electrical Performance - V_{ctl} = -3.0 V to 0 V, T_A = 25 °C, F=30 GHz

Parameter	Min	Typ	Max	Units
Frequency Range		18 - 40		GHz
Insertion Loss		1.6		dB
Attenuation Range		37		dB
Input Return Loss		12		dB
Output Return Loss		12		dB
Input IP3		25		dBm

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Specifications

Absolute Maximum Ratings

Parameter	Rating
Control Voltage, Vctl	-8 V
RF Input Power	30 dBm
Operating Temperature	-55 to 85 °C
Storage Temperature	-55 to 150 °C

Operation of this device outside the maximum ratings may cause permanent damage.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Vctl	-5.0	-3.0	0	V

Electrical performance is measured at specific test conditions. Electrical specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications, Vctl = -3.0 V to 0 V, T_A = 25 °C

Parameter	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Units
Frequency Range		18 - 30			30 - 35			35 - 40		GHz
Insertion Loss		1.5	2		1.8	2.5		2.2	3.3	dB
Attenuation Range	33	38		32	37		30	37		dB
Input Return Loss		12			12			10		dB
Output Return Loss		12			12			10		dB
Input IP3		27			24			22		dBm

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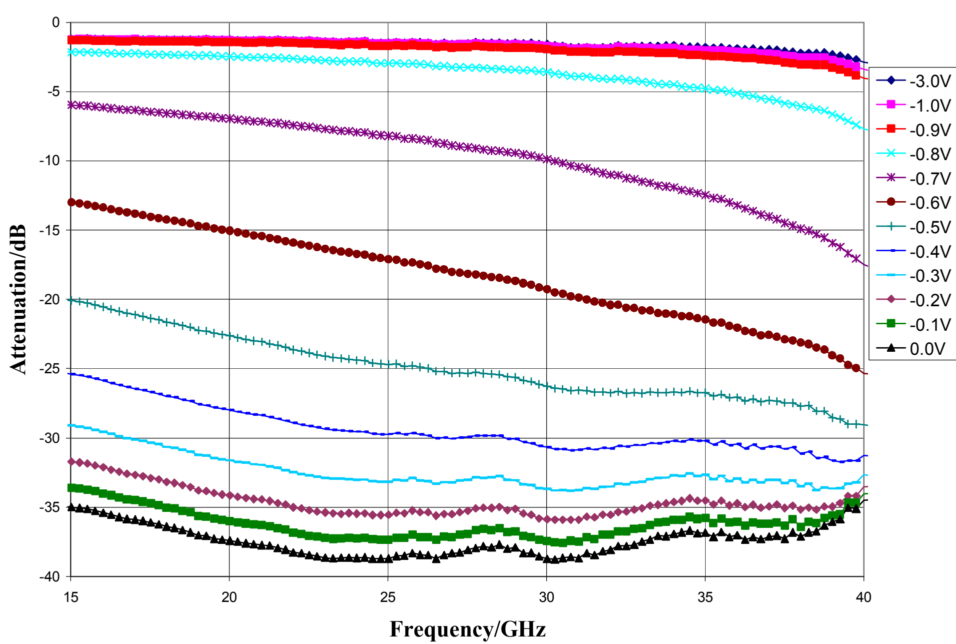
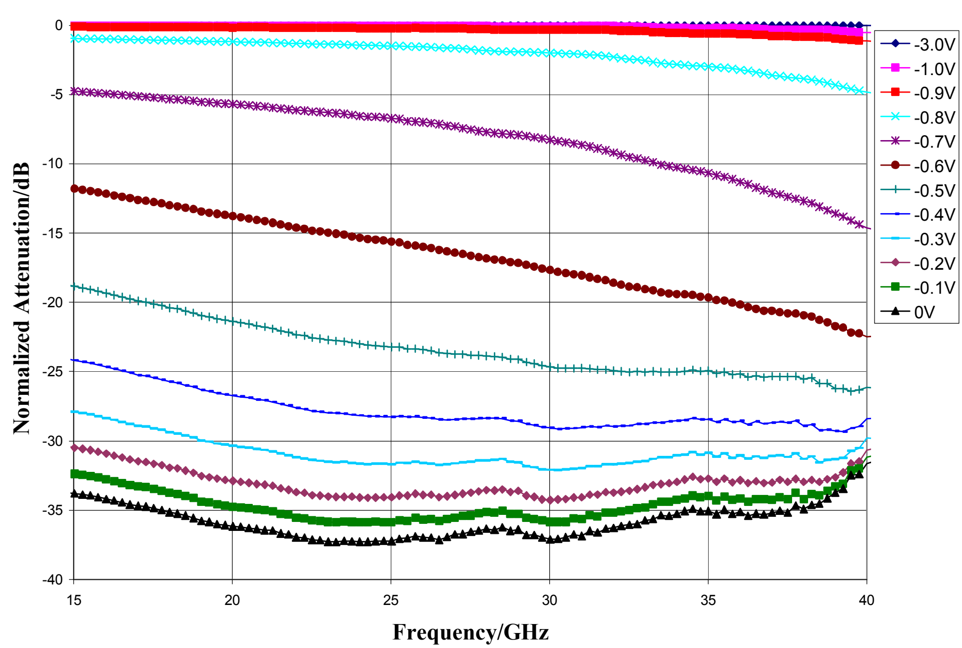
Typical Performance

Attenuation vs. Frequency over Control Voltage, T_A = 25 °C



Normalized Attenuation vs. Frequency over Control Voltage, T_A = 25 °C



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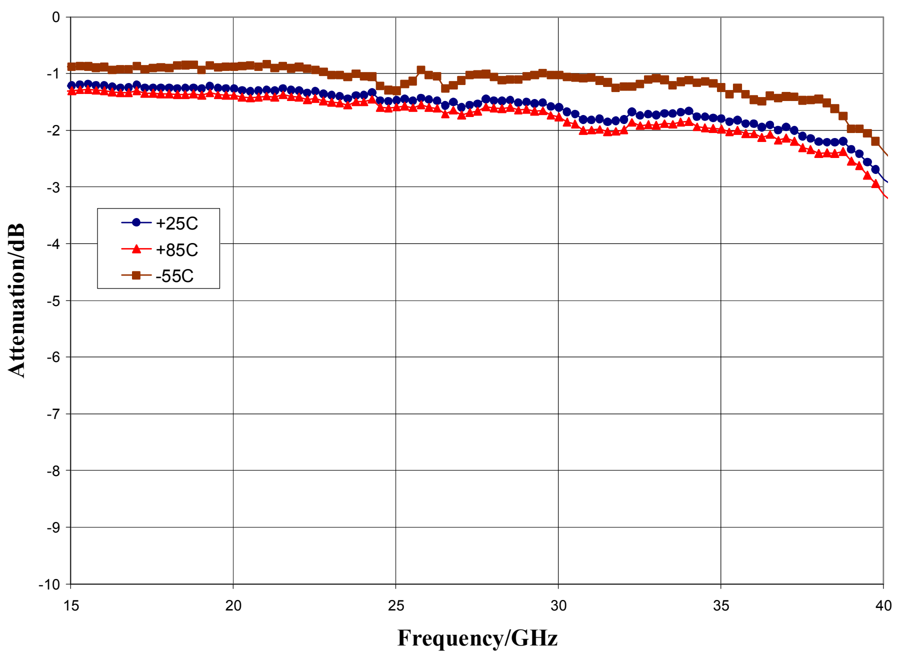
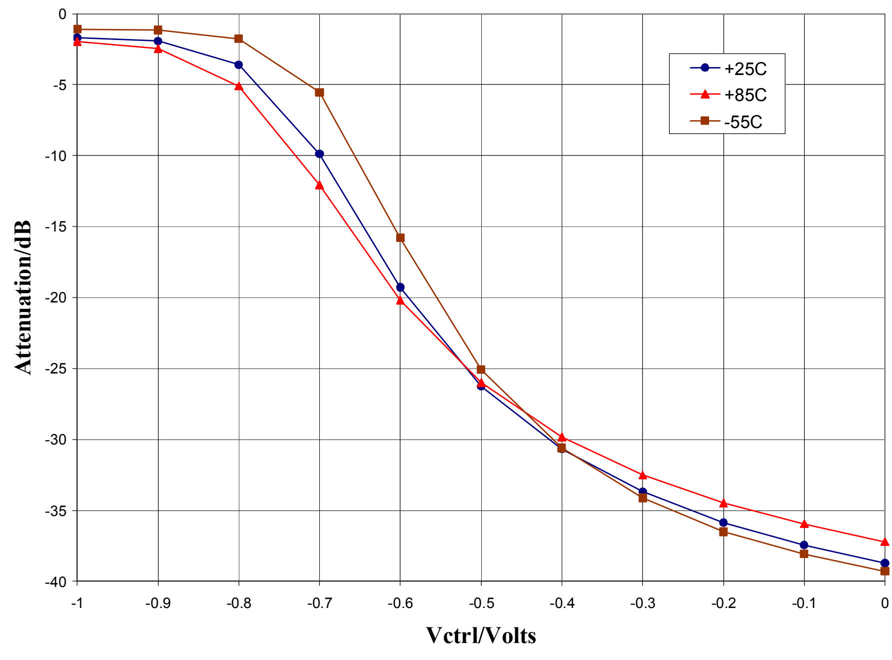
Typical Performance

Attenuation over Temperature, Insertion Loss State



Attenuation vs. Control Voltage over Temperature @ 30 GHz



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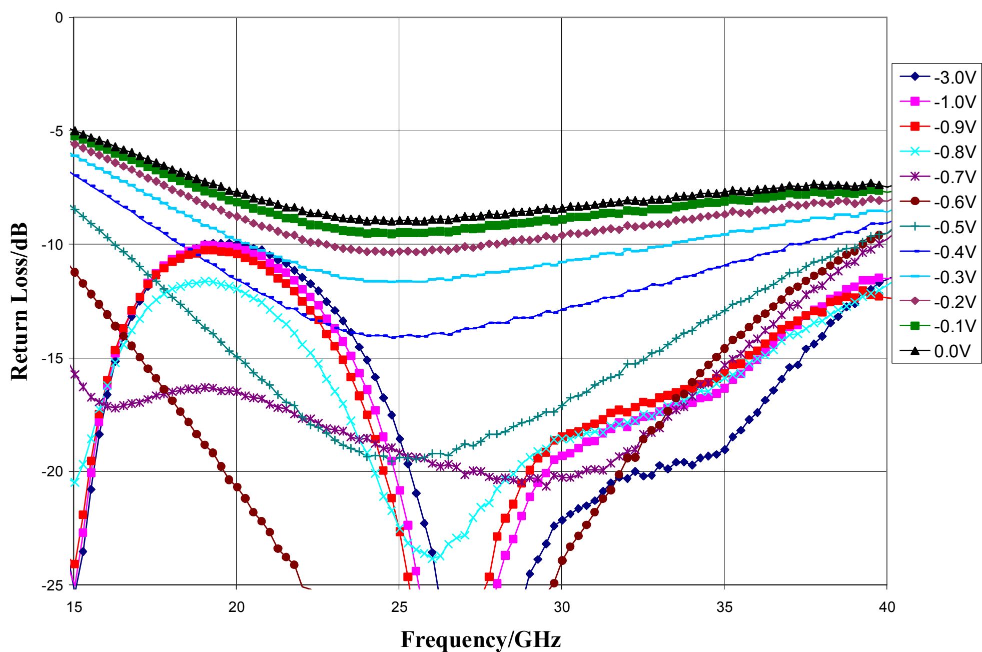
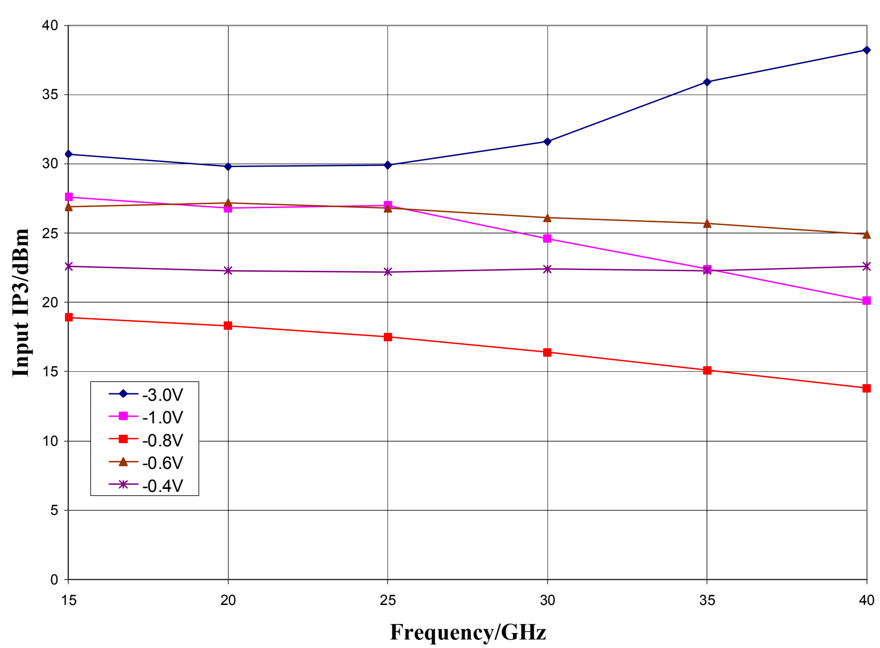
Typical Performance

Return Loss vs. Control Voltage, T_A = 25 °C



Input IP3 over Control Voltage



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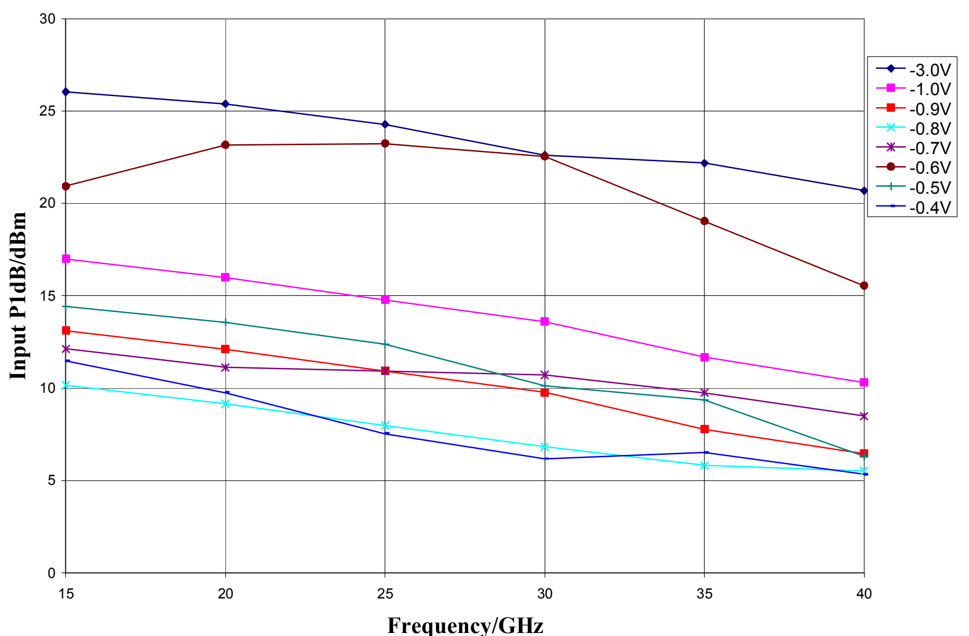
Typical Performance

Input P1dB over Control Voltage



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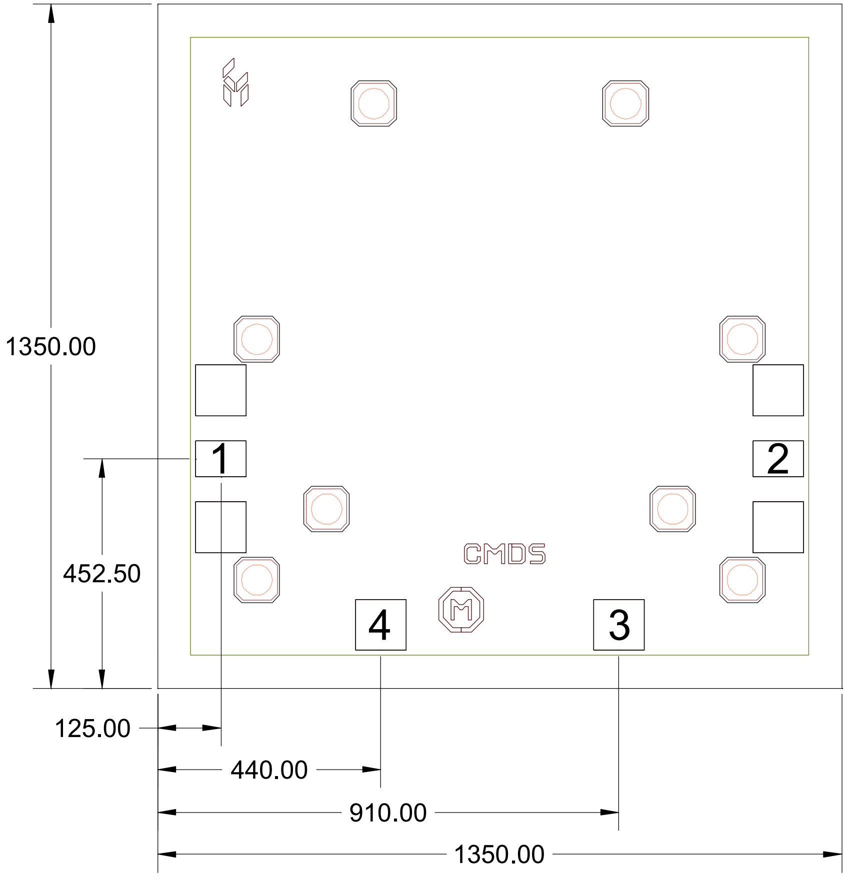
Mechanical Information

Die Outline (all dimensions in microns)



Notes:
1. No connection required for unlabeled pads
2. Backside is RF and DC ground
3. Backside and bond pad metal: Gold
4. Die is 85 microns thick
5. DC bond pads are 100 microns square

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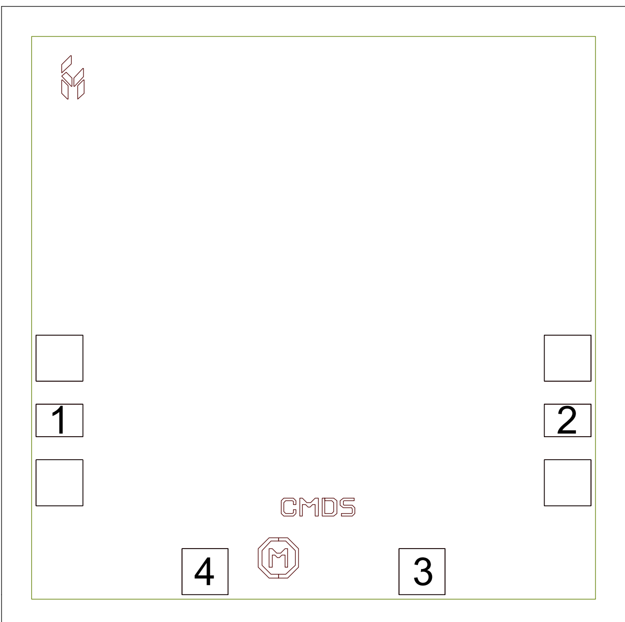
Pad Description

Pad Diagram



Functional Description

Pad	Function	Description	Schematic
1	RF in	DC blocked and 50 ohm matched	RF in
2	RF out	DC blocked and 50 ohm matched	RF out
3	Vctrl1	Control voltage 1	Vctrl1
4	Vctrl12	Control voltage 2	Vctrl2
Backside	Ground	Connect to RF / DC ground	GND

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Applications Information

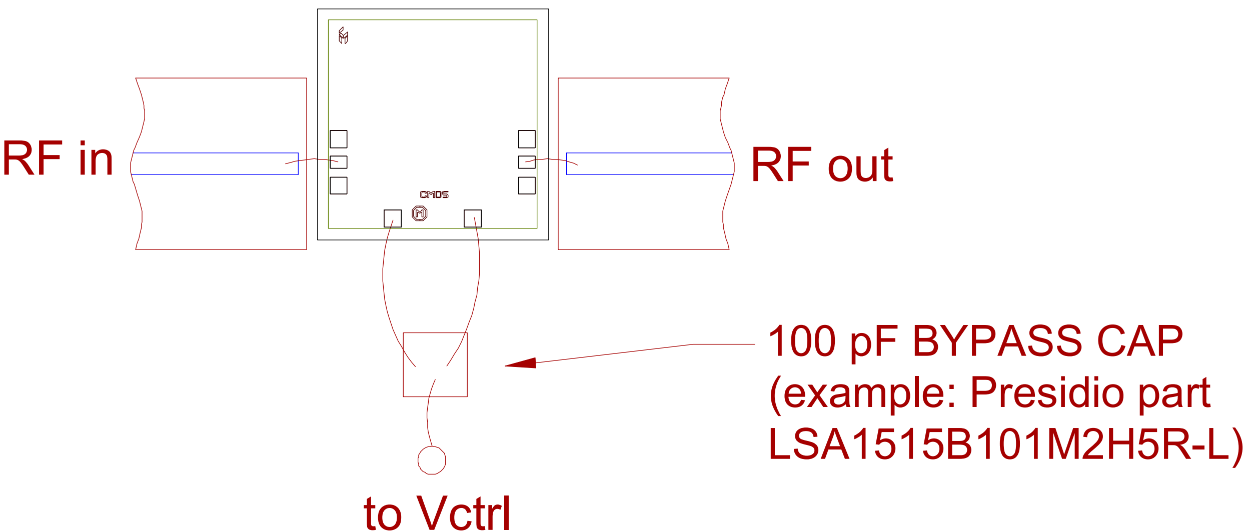
Assembly Guidelines

The backside of the CMD172 is RF ground. Die attach should be accomplished with electrically and thermally conductive epoxy only. Eutectic attach is not recommended. Standard assembly procedures should be followed for high frequency devices. The top surface of the semiconductor should be made planar to the adjacent RF transmission lines, and the RF decoupling capacitors placed in close proximity to the DC connections on chip.

RF connections should be made as short as possible to reduce the inductive effect of the bond wire. Use of a 0.8 mil thermosonic wedge bonding is highly recommended as the loop height will be minimized. The RF input and output require a single bond wire as shown.

The semiconductor is 85 um thick and should be handled by the sides of the die or with a custom collet. Do not make contact directly with the die surface as this will damage the monolithic circuitry. Handle with care.

Assembly Diagram



GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.

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Applications Information

Biasing and Operation

The CMD172 has two control voltages (Vctrl1 and Vctrl2) that should be connected together. Full attenuation range is achieved when Vctrl is varied from -3 V to 0 V.

RF power can be applied at any time.

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