CMD297

5-18 GHz Analog Phase Shifter

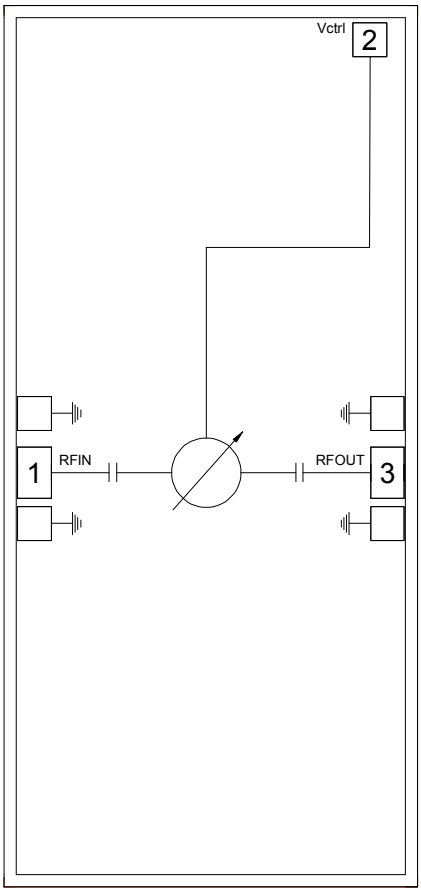
Features

- Wide bandwidth
- Wide phase shift range
- Single positive control voltage
- Small die size

Description

The CMD297 is an analog phase shifter die which operates from 5 to 18 GHz. The phase shifter utilizes a single positive control voltage of 0V to +10V to control relative phase shift over a 550 degree range at 7 GHz and a 240 degree range at 12 GHz. The CMD297 has consistent insertion loss versus phase shift and the phase shift is monotonic with respect to control voltage. The phase shifter is a 50 ohm matched design which eliminates the need for external DC blocks and RF port matching. The CMD297 offers full passivation for increased reliability and moisture protection.

Functional Block Diagram



Electrical Performance – V_{ctl} = 0 V to +10 V, T_A = 25 °C, F = 12 GHz

Parameter	Min	Typ	Max	Units
Frequency Range		5 - 18		GHz
Phase Shift Range		240		degrees
Insertion Loss		3		dB
Input Return Loss		10		dB
Output Return Loss		10		dB
Phase Voltage Sensitivity		24		deg / Volt

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Specifications

Absolute Maximum Ratings

Parameter	Rating
Control Voltage, Vctl	+ 11 V
Reverse Current	5 mA
RF Input Power	+30 dBm
Channel Temperature, Tch	150 °C
Power Dissipation, Pdiss	2 W
Thermal Resistance, Θ_{JC}	32.2 °C/W
Operating Temperature	-55 to 85 °C
Storage Temperature	-55 to 150 °C

Exceeding any one or combination of the maximum ratings may cause permanent damage to the device.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Vctl	0		10	V

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

Electrical Specifications, Vctl = 0 V to +10 V, T_A = 25 °C

Parameter	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Units
Frequency Range	5 - 10			10 - 13			13 - 18			GHz
Phase Shift Range	240	500		150	250		70	150		degrees
Insertion Loss		7	17		3.5	8		2.5	7	dB
Input Return Loss		10			10			8		dB
Output Return Loss		10			10			8		dB
Control Voltage Range	0		10	0		10	0		10	Volts
Phase Voltage Sensitivity		57			24			9		deg / Volt
Phase Temperature Sensitivity		0.15			0.1			0.05		deg / °C

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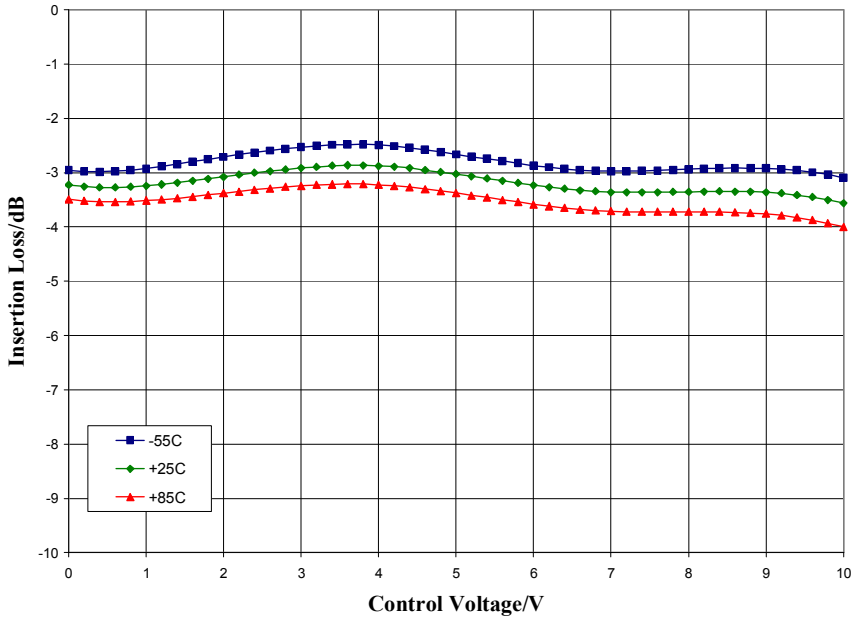
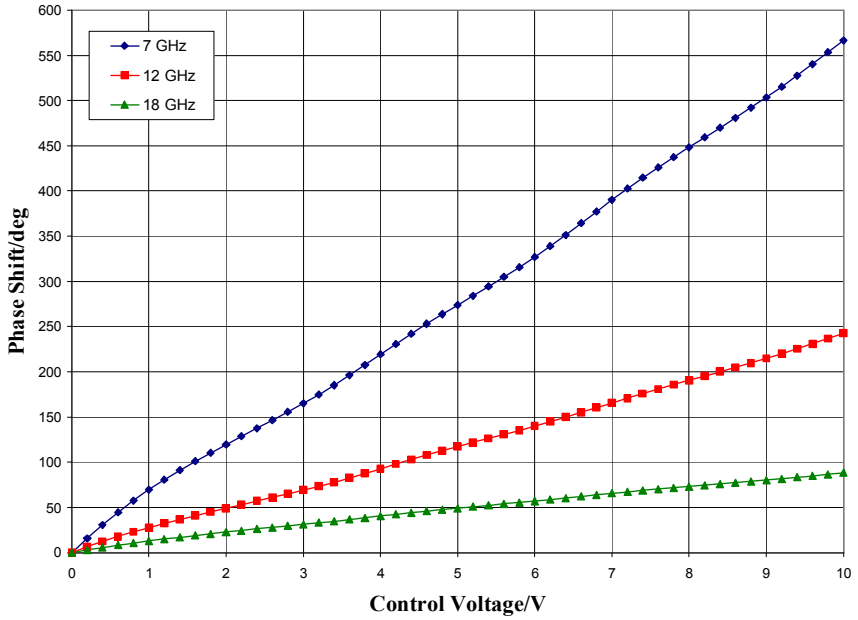
Typical Performance

Insertion Loss vs. Control Voltage @ 12 GHz



Phase Shift vs. Control Voltage, T_A = 25 °C



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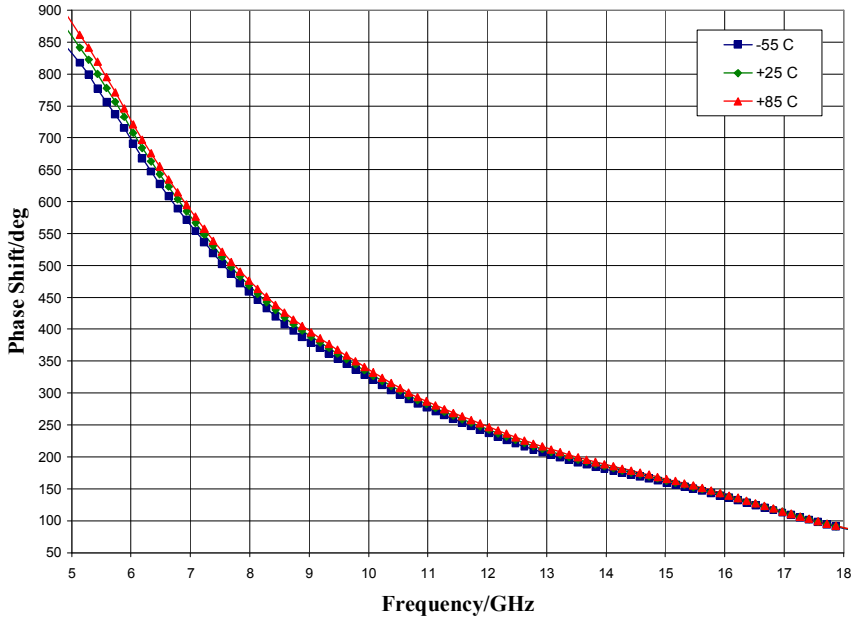
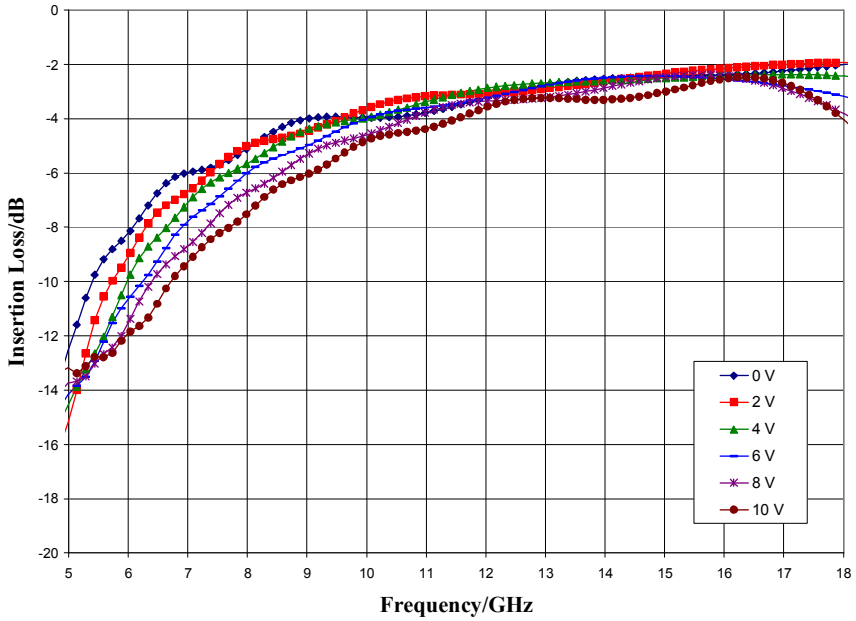
Typical Performance

Phase Shift vs. Frequency @ Vctl = 10V (Relative to Vctl = 0V)



Insertion Loss vs. Frequency, T_A = 25 °C



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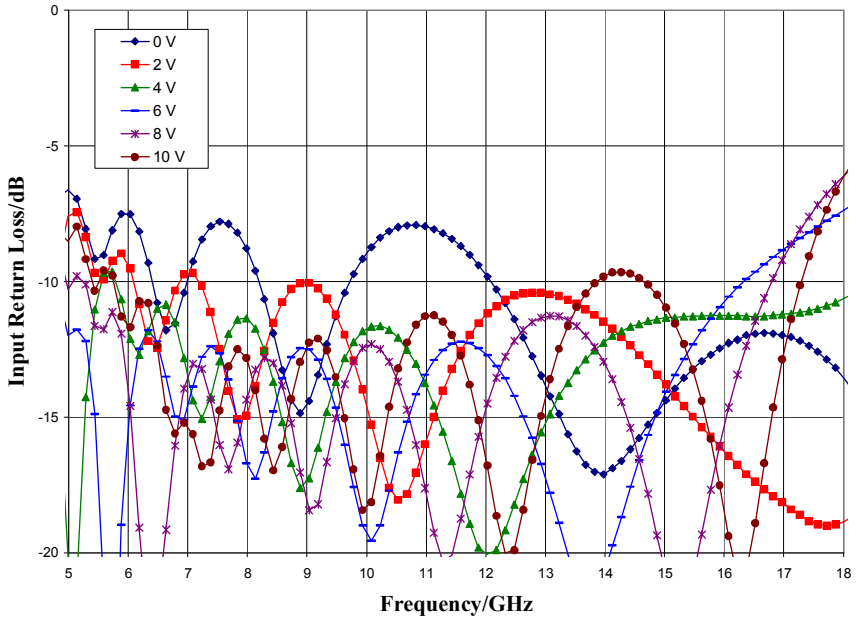
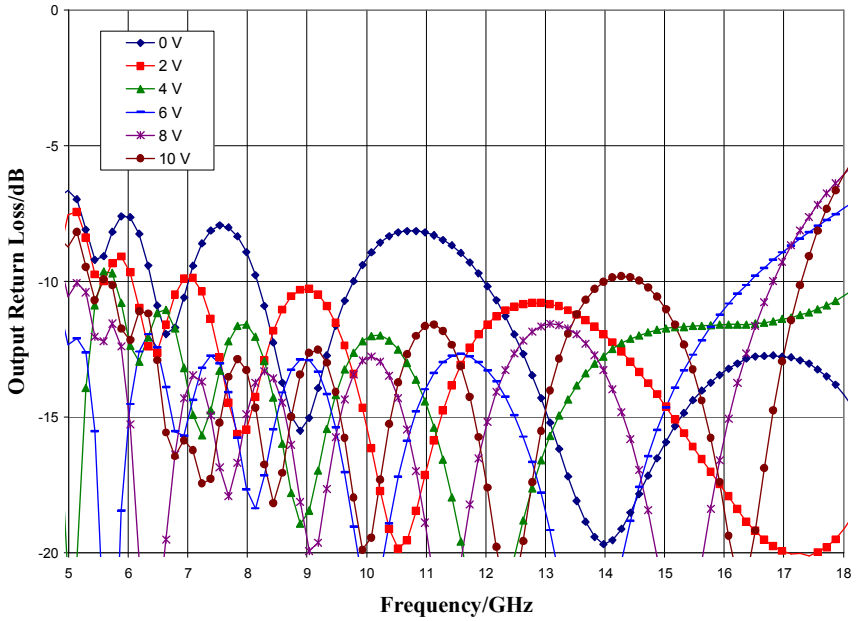
Typical Performance

Input Return Loss, T_A = 25 °C



Output Return Loss, T_A = 25 °C



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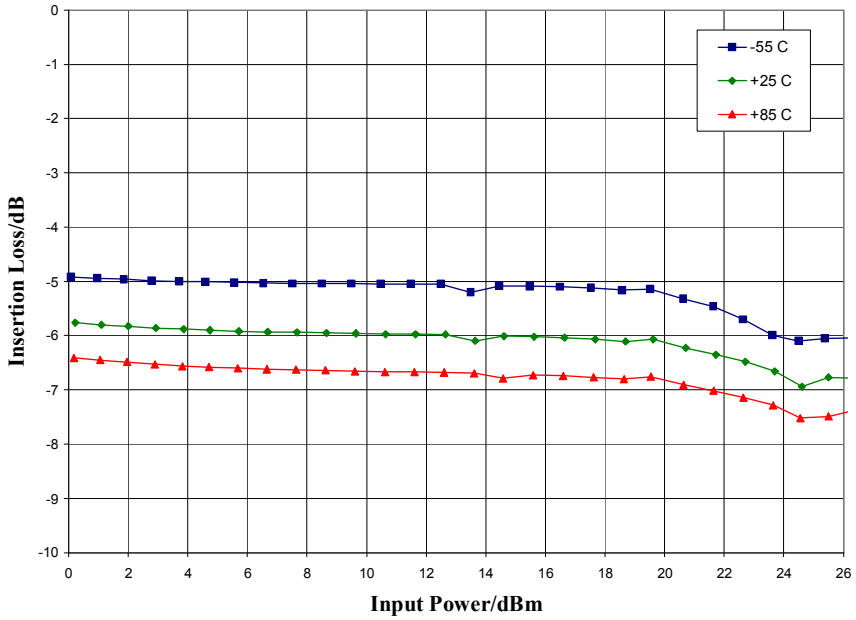
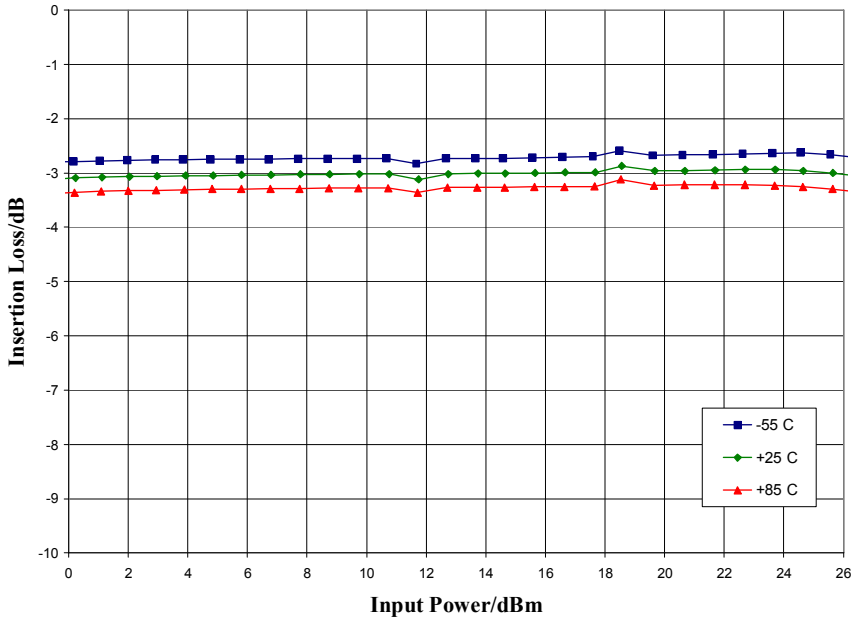
Typical Performance

Insertion Loss vs. Pin @ 7 GHz, Vctl = 0V



Insertion Loss vs. Pin @ 12 GHz, Vctl = 0V



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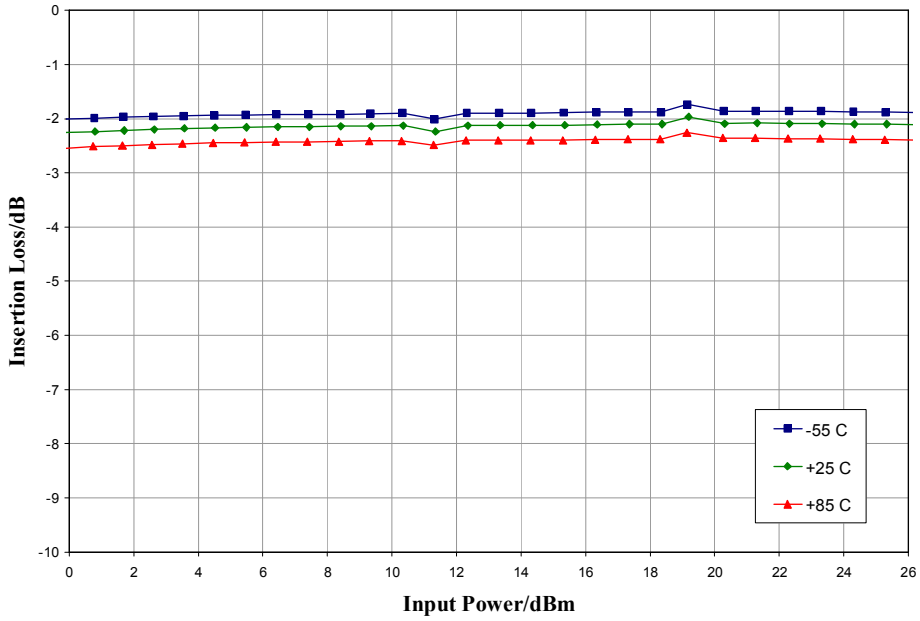
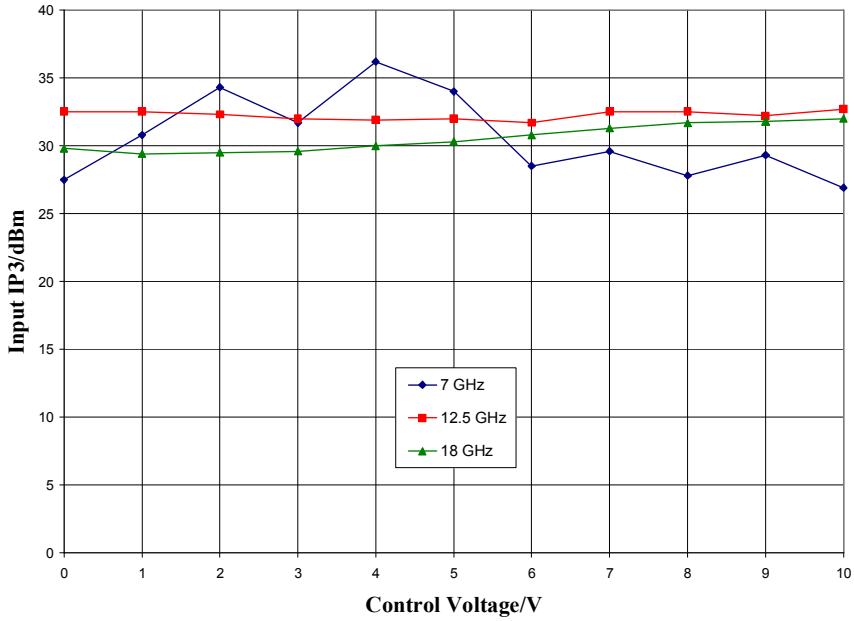
Typical Performance

Insertion Loss vs. Pin @ 18 GHz, Vctl = 0V



Input IP3 vs. Control Voltage, T_A = 25 °C



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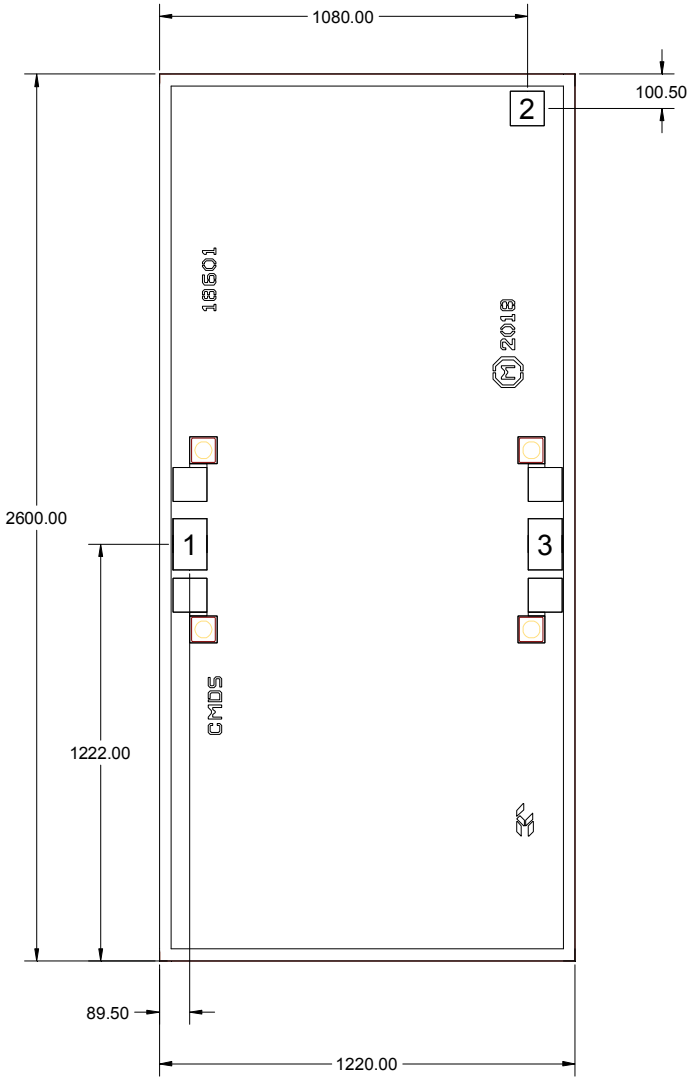
Mechanical Information

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 100 microns thick
5. DC bond pad (2) is 100 x 100 microns
6. RF bond pads (1, 3) are 100 x 150 microns

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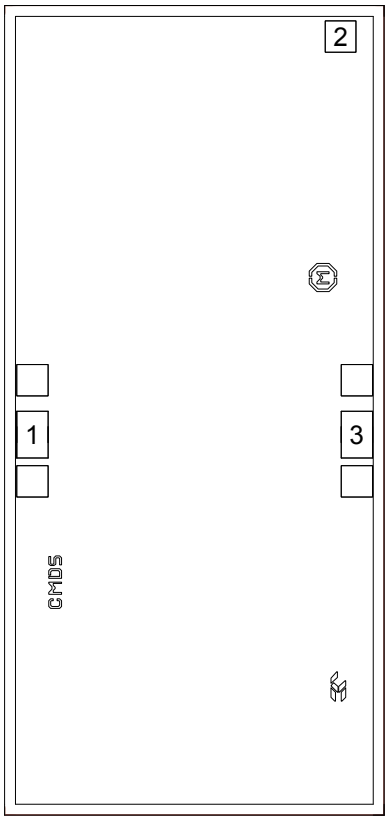
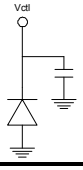
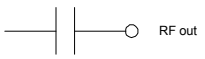
Pad Description

Pad Diagram



Functional Description

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

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Applications Information

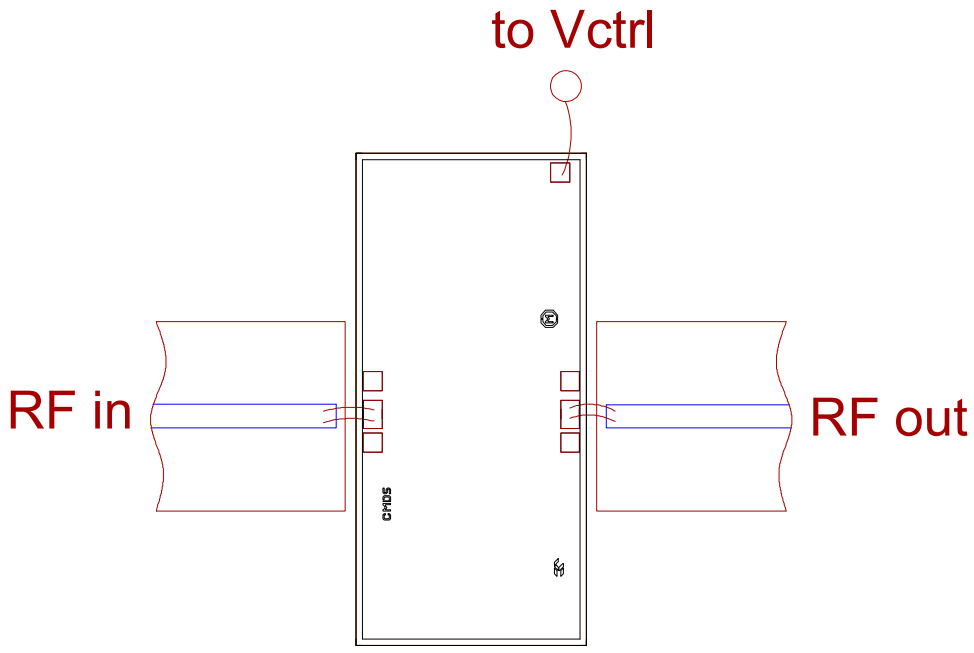
Assembly Guidelines

The backside of the CMD297 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 100 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 CMD297 has a single control voltage (Vctrl). Full phase shift range is achieved when Vctrl is varied from 0 to +10 V.

RF power can be applied at any time.

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