

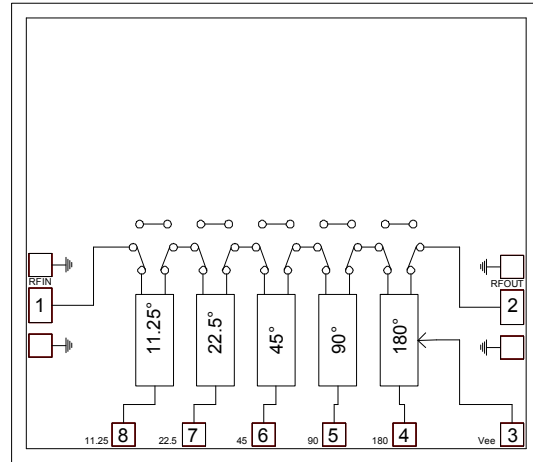
Features

- ▶ Low phase error
- ▶ Low insertion loss
- ▶ 360° phase shift, LSB = 11.25°
- ▶ Single bit negative logic

Description

The CMD174 die is a GaAs MMIC 5-bit phase shifter. The CMD174 operates from 3 to 6 GHz and provides 0 to 360 degrees of monotonic phase coverage, with a LSB of 11.25 degrees. The device is controlled with single bit negative logic of 0 or -3 V and features an insertion loss of 7.6 dB and a phase error of ± 2 degrees. The CMD174 is a 50 ohm matched design which eliminates the need for external DC blocks and RF port matching.

Functional Block Diagram



Electrical Performance - $V_{ee} = -3$ V, $V_{ctl} = 0/-3$ V, $T_A = 25$ °C, $F = 4.5$ GHz

Parameter	Min	Typ	Max	Units
Frequency Range	3 - 6			GHz
Insertion Loss		7.6		dB
Input Return Loss		15		dB
Output Return Loss		20		dB
Phase Error		± 2		deg
Input P1dB		26.5		dBm
Supply Current		4		mA

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Specifications

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage, V _{ee}	-8.0 V
RF Input Power	+30 dBm
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
V _{ee}	-5.0		-3.0	V
I _{ee}		4		mA

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

Truth Table

Control Voltage Input					Phase Shift (degrees)
11.25	22.5	45	90	180	
High	High	High	High	High	Reference
Low	High	High	High	High	11.25
High	Low	High	High	High	22.5
High	High	Low	High	High	45
High	High	High	Low	High	90
High	High	High	High	Low	180
Low	Low	Low	Low	Low	348.75

Control Voltage

State	Bias Condition
High	V _{ee} ± 0.3 V
Low	0 ± 0.3 V

Specifications

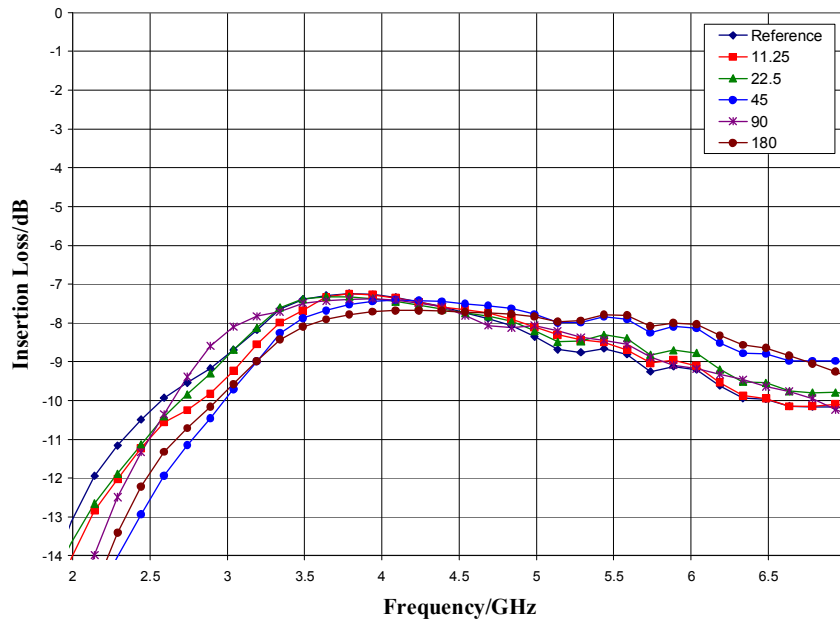
Electrical Specifications - $V_{ee} = -3.0\text{ V}$, $V_{ctl} = 0/-3\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$

Parameter	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Units
Frequency Range	3 - 3.5			3.5 - 5			5 - 6			GHz
Insertion Loss		8.5	11		7.6	9		8.5	10	dB
Input Return Loss		17			17			12		dB
Output Return Loss		17			17			12		dB
Phase Error		+5 / - 1	+13 / -5		± 2	+7 / - 5		± 4	± 8	deg
Insertion Loss Variation		± 0.5			± 0.25			± 0.5		dB
Input P1dB		26.5			26.5			26		dBm
Input IP3		38			37			37		dBm
Supply Current		4			4			4		mA

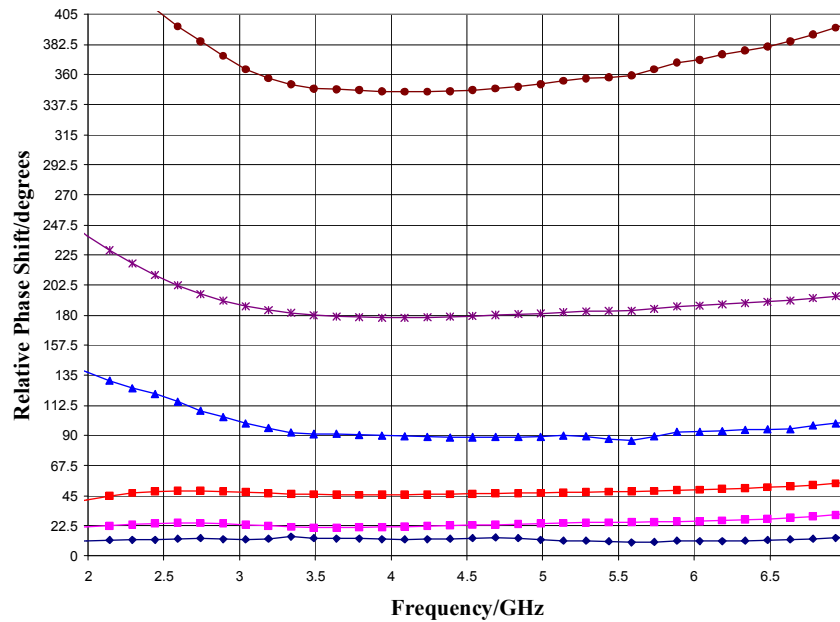
Note: Specification applies to major states

Typical Performance

Insertion Loss, Major States, $V_{ee} = -3.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$



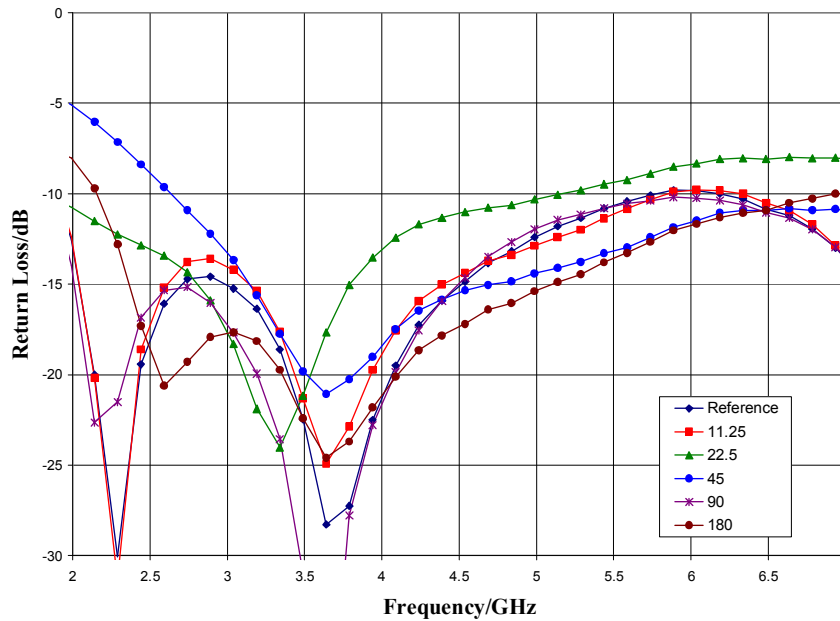
Relative Phase Shift, Major States and All On State, $V_{ee} = -3.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$



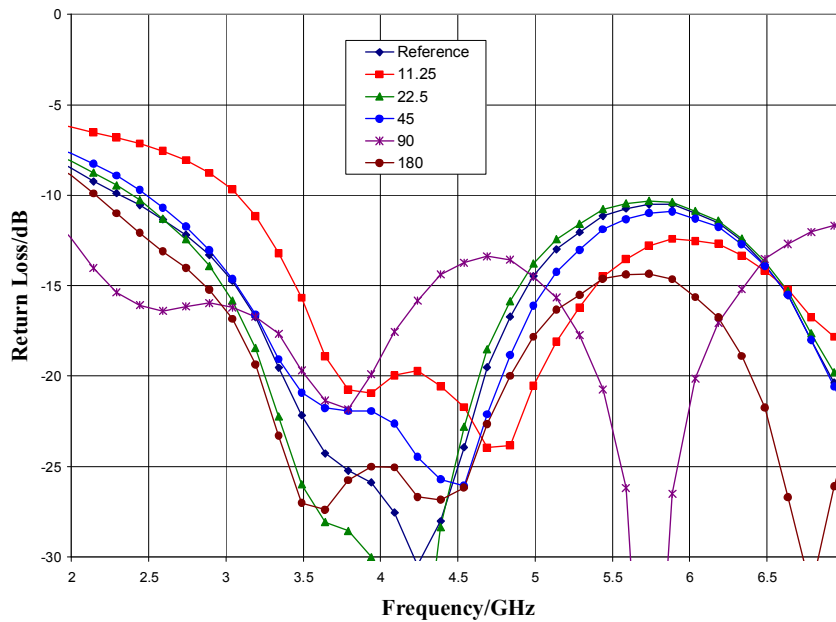
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Typical Performance

Input Return Loss, Major States, $V_{cc} = -3.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$



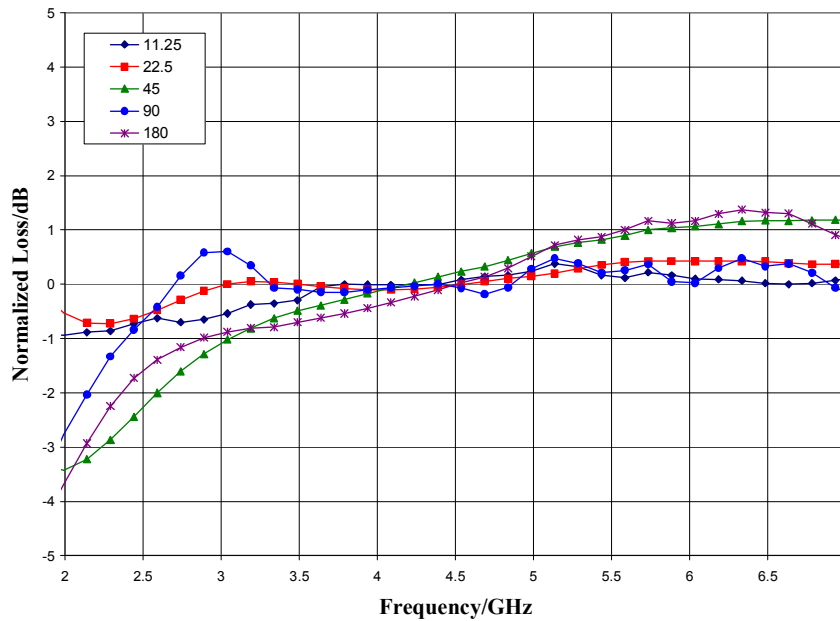
Output Return Loss, Major States, $V_{cc} = -3.0\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$



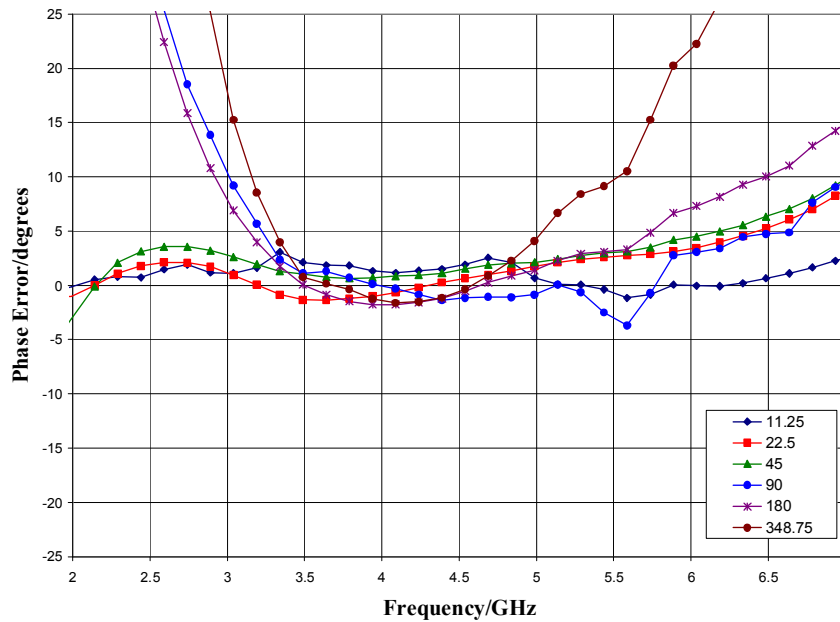
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Typical Performance

Normalized Loss, Major States, $V_{ee} = -3.0$ V



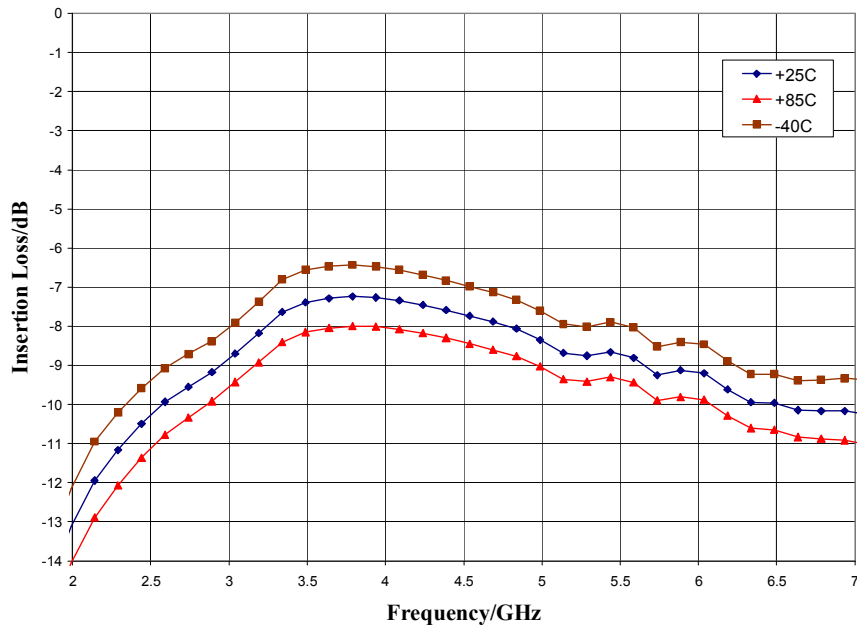
Phase Error, Major States and All On State, $V_{ee} = -3.0$ V



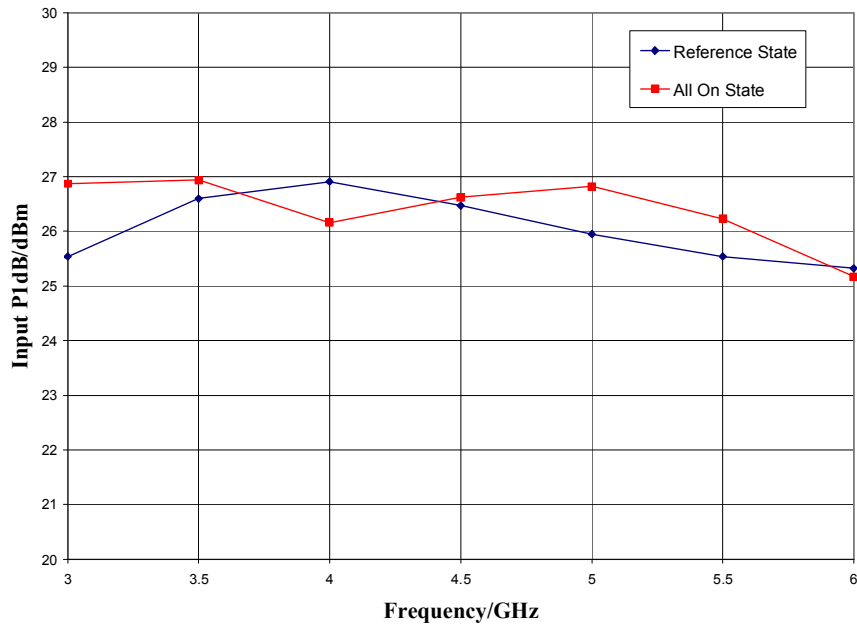
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Typical Performance

Insertion Loss vs. Temperature, Reference State, $V_{ee} = -3.0$ V



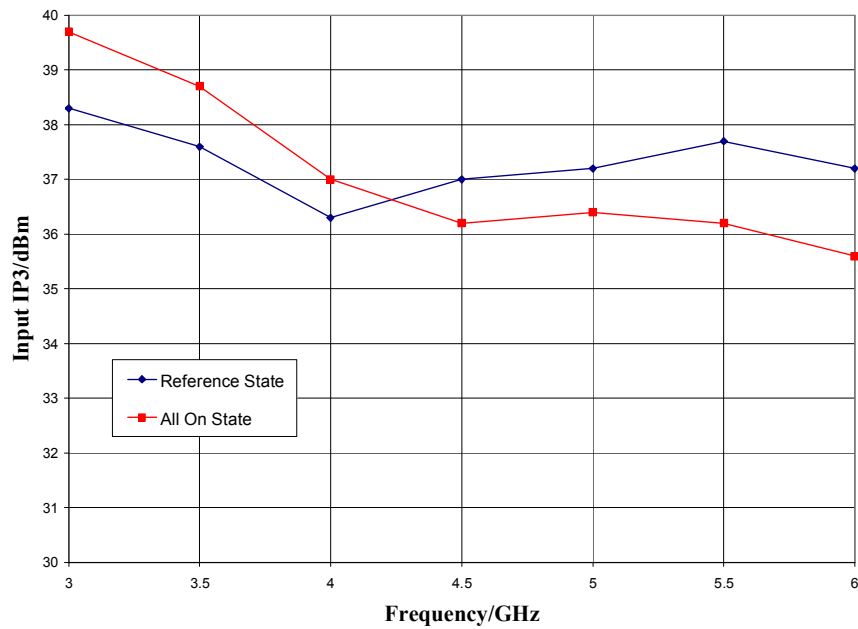
Input P1dB, $V_{ee} = -3.0$ V



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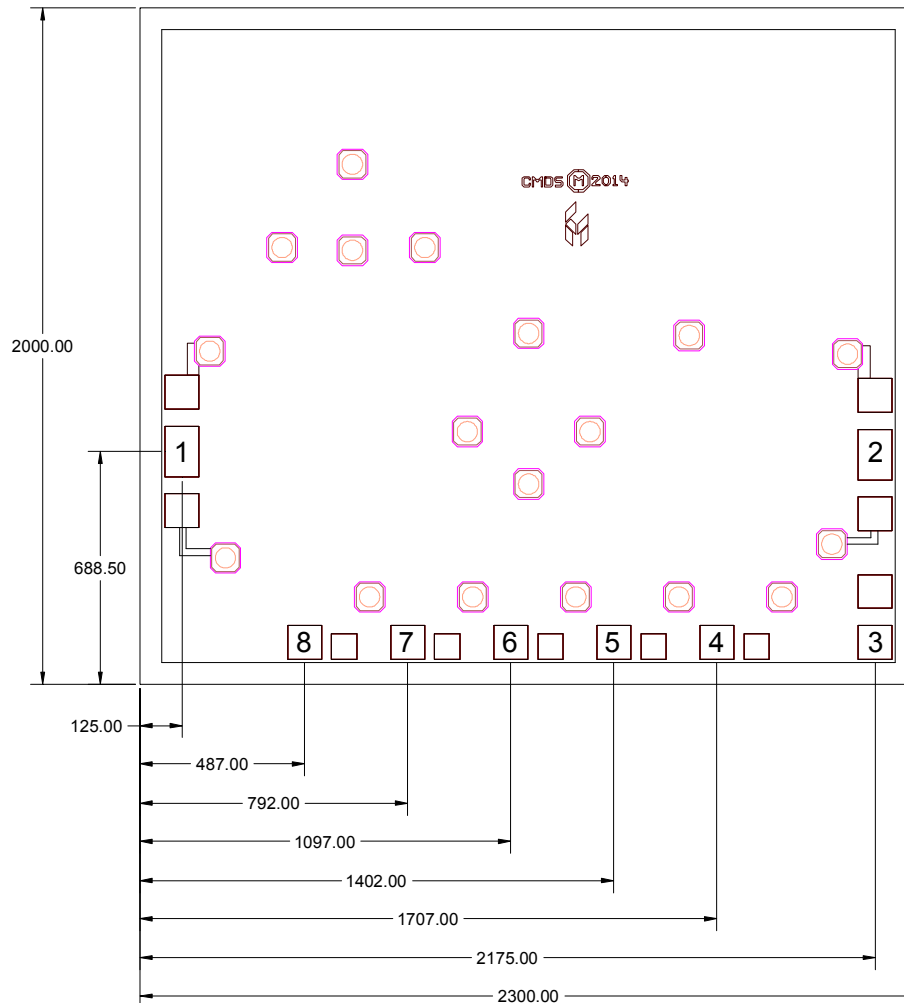
Typical Performance

Input IP3, $V_{cc} = -3.0$ V



Mechanical Information

Die Outline (all dimensions in microns)



Notes:

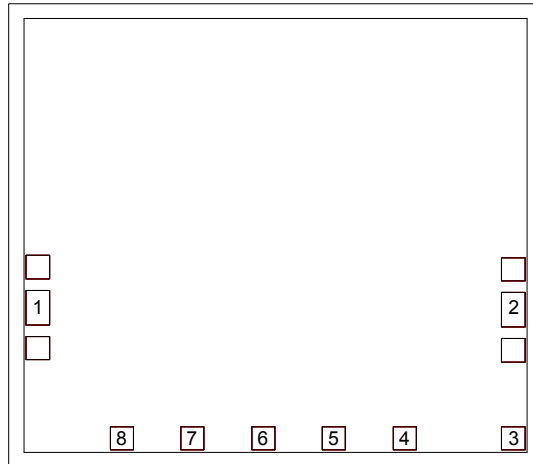
1. No connection required for unlabeled pads
2. Backside is RF and DC ground
3. Backside and bond pad metal: Gold
4. Die is 85 microns thick
5. DC bond pads are 100 microns square

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



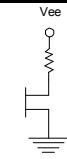
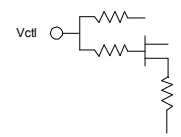

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Pin Description

Pad Diagram



Functional Description

Pad	Function	Description	Schematic
1	RF in	DC blocked and 50 ohm matched	
2	RF out	DC blocked and 50 ohm matched	
3	Vee	Supply Voltage	
4	180	180° control input	
5	90	90° control input	
6	45	45° control input	
7	22.5	22.5° control input	
8	11.25	11.25° control input	
Backside	Ground	Connect to RF / DC ground	

Please note, all information contained in this data sheet is subject to change without notice.

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