

## Features

- Operates 1.805 to 1.88 GHz (DCS)
- Operates 1.93 to 1.99 GHz (PCS)
- Low Amplitude Ripple
- Linear Phase
- 50 Ohm Nominal Impedance
- Continuously Variable Across a Full 360 degree range
- Test Boards Available
- 4x6 mm PQFN Package

## Description

M/A-COM's MAMDCC0002 is a Vector Modulator that significantly reduces the required board space compared to hybrid solutions. The monolithic passive elements will lead to greater repeatability lot-to-lot. Low amplitude ripple will provide superior performance. High intercept and compression points will contribute to more linear system performance. MAMDCC0002 is ideally suited for wireless infrastructure applications.

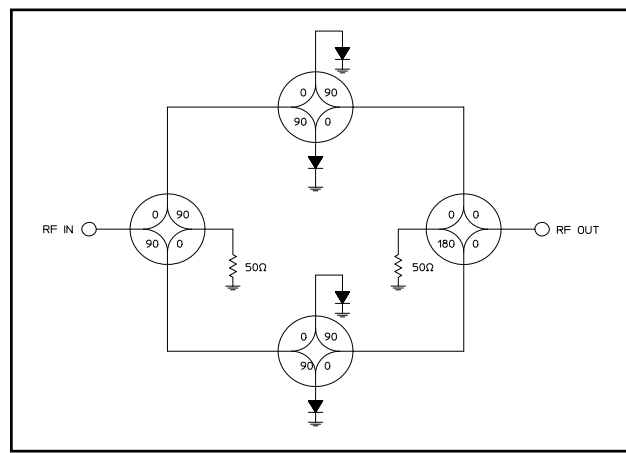
M/A-COM's MADRCC0002 Dual Linearizer is designed to simplify the control of Vector Modulators. See Figure 1 and App Note AN3001.

## Ordering Information

Part Number	Package
MAMDCC0002	Bulk Packaging
MAMDCC0002TR	1000 piece reel
MAMDCC0002-DC000	Sample Test Board

Note: Reference Application Note M513 for reel size information.

## Functional Schematic



## Pin Configuration

Pin No.	Function	Pin No.	Function
1	NC	17	NC
2	NC	18	NC
3	NC	19	NC
4	NC	20	NC
5	NC	21	NC
6	NC	22	NC
7	NC	23	NC
8	NC	24	BIAS 2B
9	BIAS 1A	25	NC
10	NC	26	GND
11	GND	27	RF OUT
12	RF IN	28	GND
13	GND	29	NC
14	NC	30	BIAS 1B
15	BIAS 2A	31	NC
16	NC	32	NC

The exposed pad centered on the package bottom must be connected to RF and DC ground. (For PQFN Packages)

## Vector Modulator, 1.805 to 1.88 GHz (DCS) and 1.93 to 1.99 GHz (PCS)

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### Electrical Specifications: $T_A = 25^\circ\text{C}$ , $Z_0 = 50\Omega$

Parameter	Test Conditions	Units	Min	Typ	Max
Frequency	DCS Band PCS Band	GHz GHz	1.805 1.93	— —	1.88 1.99
Impedance	—	Ohms	—	50	—
Reference Loss	$Z = 50\text{ Ohms}$	dB	-12.5	—	-10.0
Attenuation Range	$Z = 50\text{ Ohms}$ Above Reference Loss	dB	10	—	—
Phase Shift Range	$Z = 50\text{ Ohms}$ , Over minimum Attenuation Range	deg	0	—	360
Amplitude Ripple	$Z = 50\text{ Ohms}$ , Ref Loss	dB	—	$\pm 0.07$	$\pm 0.15$
	$Z = 50\text{ Ohms}$ , 5 dB above Ref Loss	dB	—	$\pm 0.07$	$\pm 0.20$
	$Z = 50\text{ Ohms}$ , 10 dB above Ref Loss	dB	—	$\pm 0.09$	$\pm 0.20$
Deviation from Linear Phase	$Z = 50\text{ Ohms}$ , Ref Loss	deg	—	$\pm 0.15$	$\pm 0.5$
	$Z = 50\text{ Ohms}$ , 5 dB above Ref Loss	deg	—	$\pm 0.25$	$\pm 0.5$
	$Z = 50\text{ Ohms}$ , 10 dB above Ref Loss	deg	—	$\pm 0.15$	$\pm 0.5$
Return Loss - Input Return Loss - Output	Over 10 dB Attenuation Range	dB	15	—	—
		dB	14	—	—
Input $IP_3$	Over 10 dB Attenuation Range	dBm	—	+41	—
Input $P_{1dB}$	Over 10 dB Attenuation Range	dBm	—	+29	—
Noise Figure	Over 10 dB Attenuation Range	dB	—	—	Note 1
Switching Speed	50% Control to 10% / 90% RF	ns	—	500	—
I Supply	—	mA	—	—	25

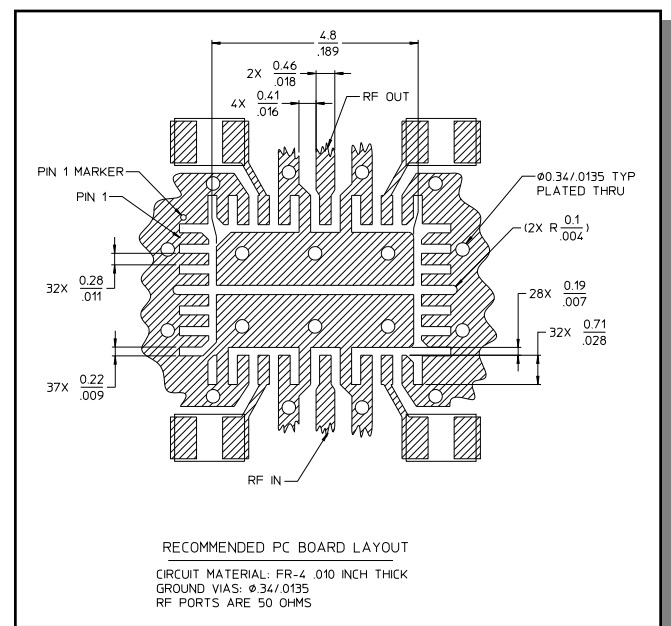
1. Noise figure is approximately equal to the absolute attenuation.

### Recommended PCB Configuration

### Absolute Maximum Ratings<sup>2,3</sup>

Parameter	Absolute Maximum
Max. Input Power 1.7 to 2.1 GHz Other Frequencies	+30 dBm +24 dBm
DC Voltages <sup>4</sup> $V_{bias1}$ or $V_{bias2}$	+1.0V
DC Current	50 mA Max per Bias
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +125°C

- Exceeding any one or combination of these limits may cause permanent damage to this device.
- M/A-COM does not recommend sustained operation near these survivability limits.
- Note that external dropping resistors are required to limit the current and voltage on the PIN diodes.

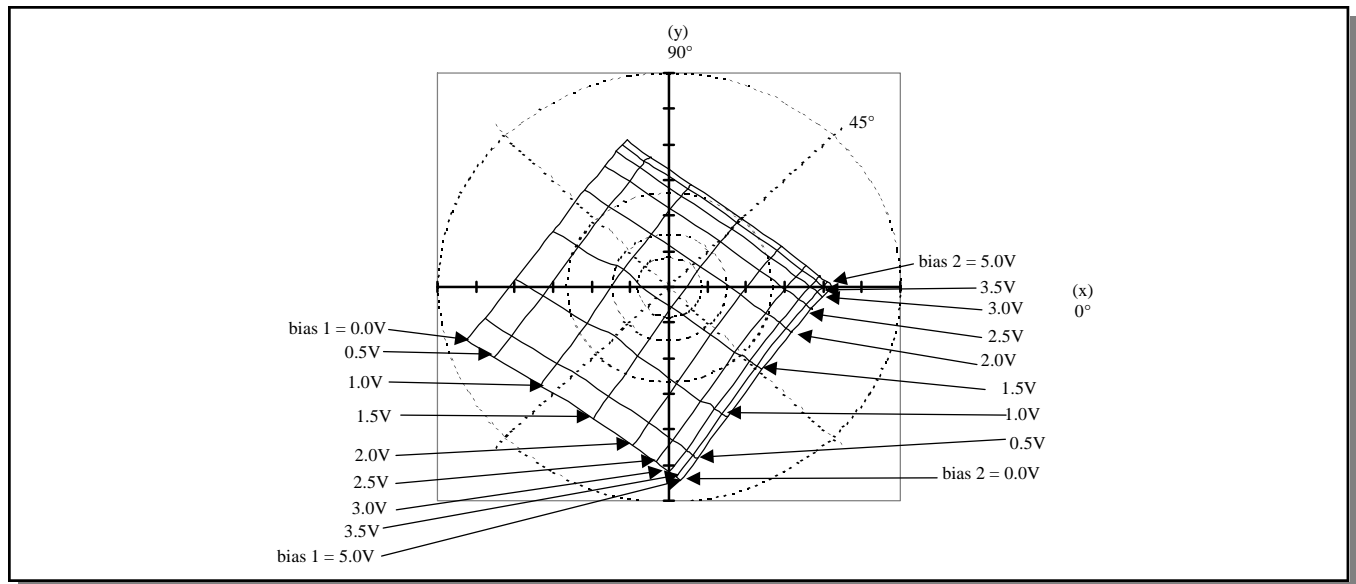


## Vector Modulator, 1.805 to 1.88 GHz (DCS) and 1.93 to 1.99 GHz (PCS)

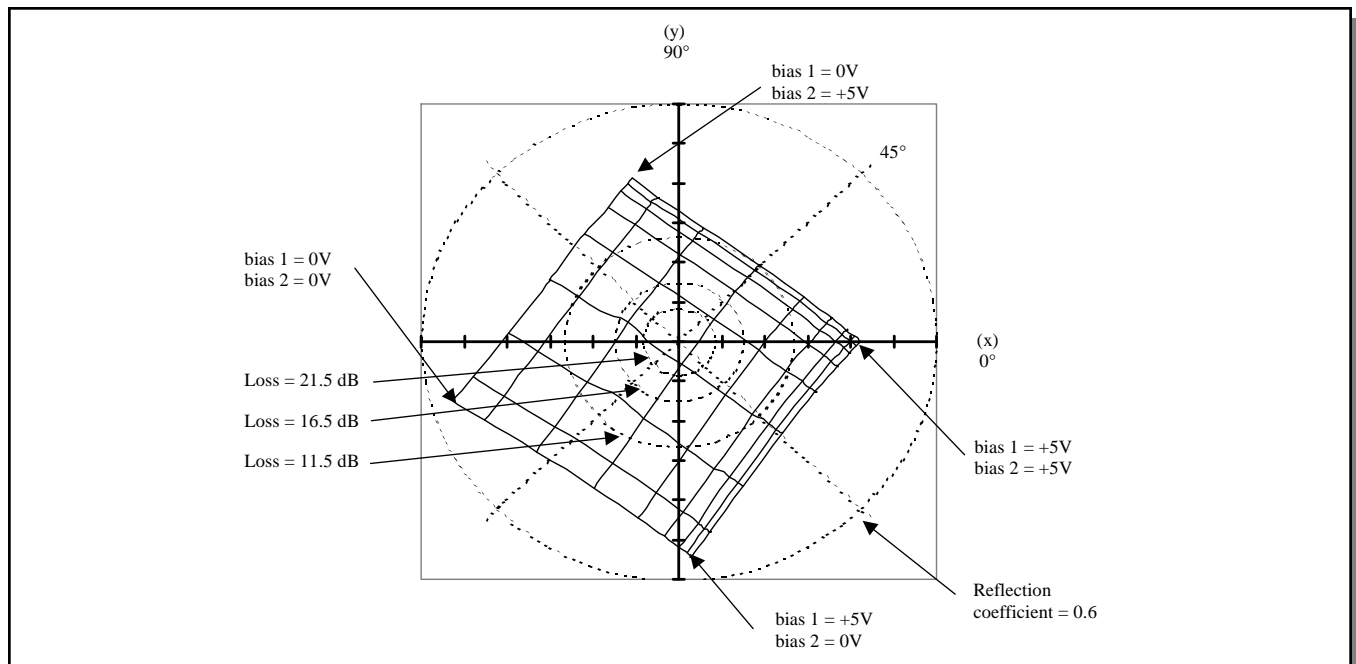
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**Phase and Attenuation of MAMDCC0002, Vector Modulator Linearized with  
MADRCC0002 Dual Linearizer<sup>5,6,7,8</sup>**

**Figure 1A**



**Figure 1B**



5. Tic marks on x,y axes refer to reflection coefficient in increments of 0.1V. Reflection coefficients vary from -0.6 to +0.6 on both the x and y axes.
6. Data is for vector modulators driven by linearizers. See Application Note AN3001.
7. Inputs to the linearizers vary from 0 to 5V.
8. The phase with the inputs to both linearizers set to +5V is arbitrarily called zero degrees.

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### Phase and Attenuation of MAMDCC0002 Vector Modulator with Current Drive<sup>9,10</sup>

Figure 2A

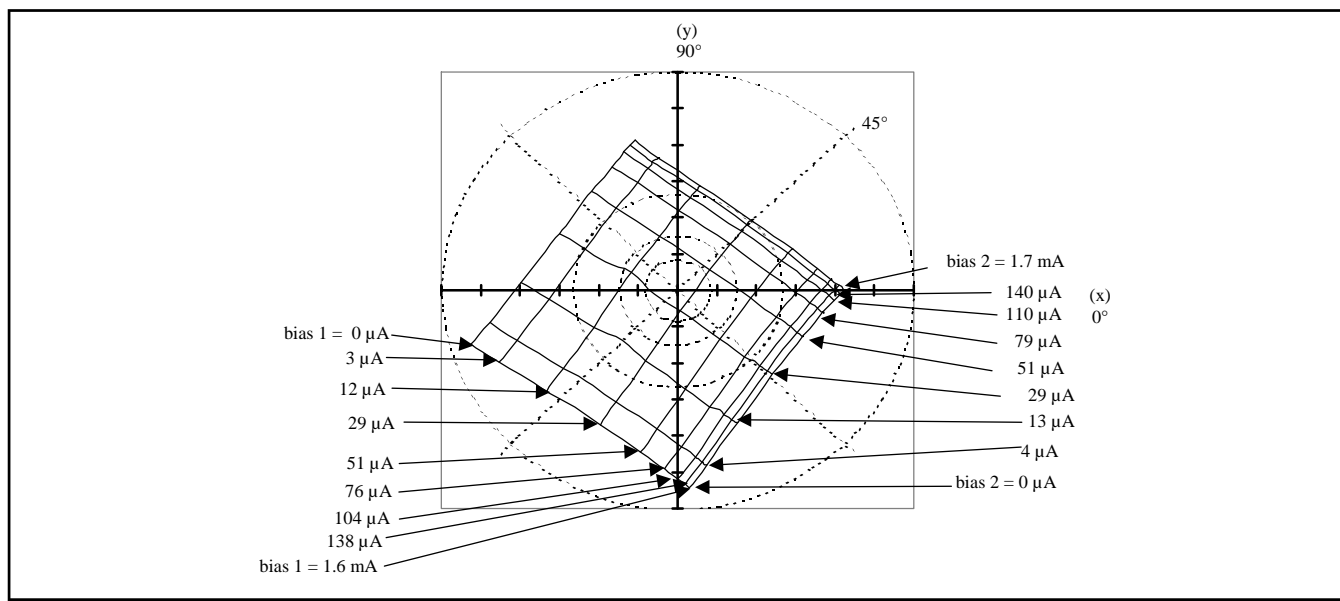
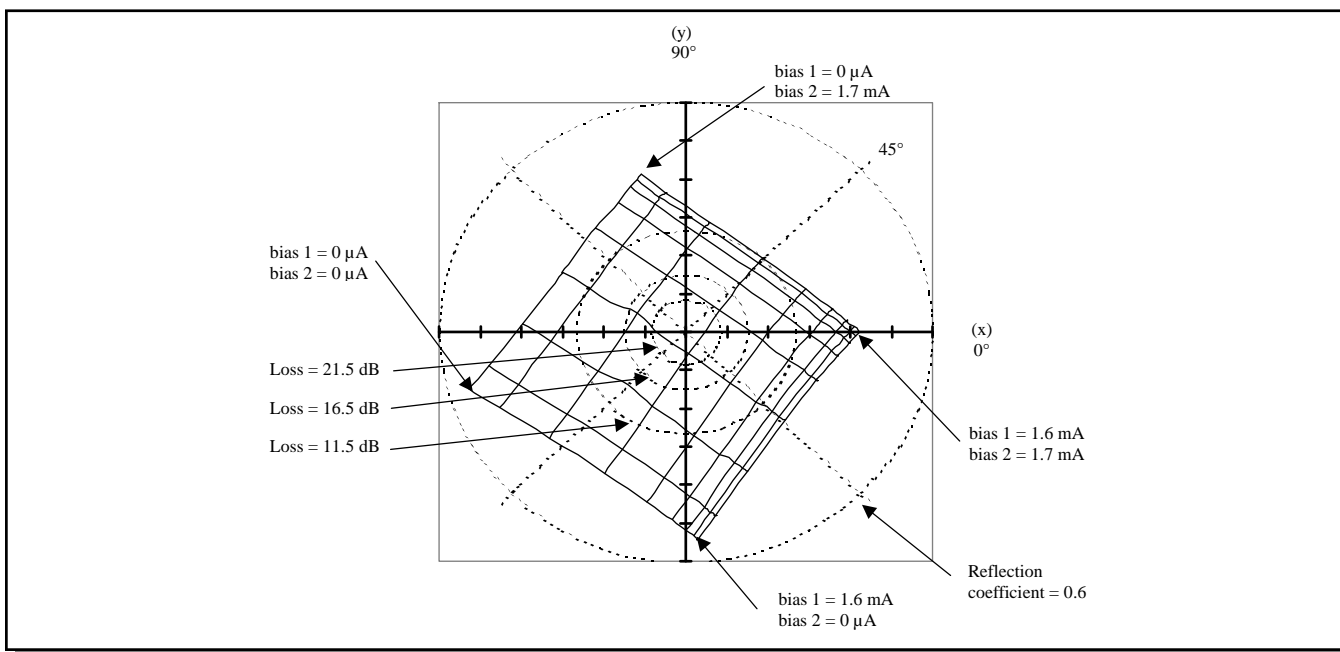


Figure 2B



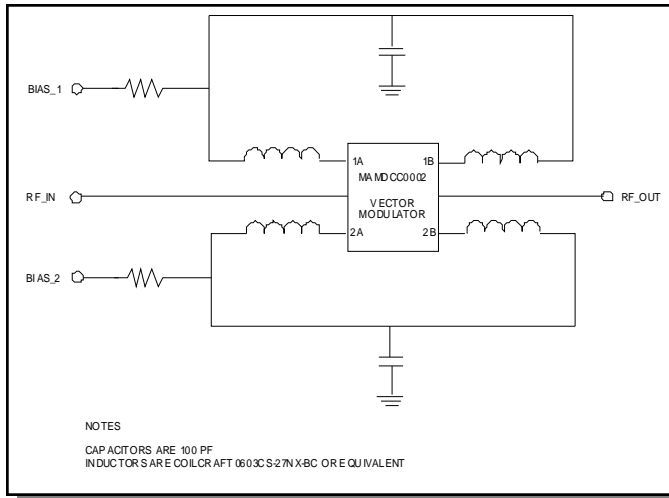
9. Tic marks on x,y axes refer to reflection coefficient in increments of 0.1. Reflection coefficients vary from -0.6 to +0.6 on both the x and y axes.

10. The phase with the inputs to both linearizers set to +15 mA is arbitrarily called zero degrees.

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### Schematic with Off-Chip Components



### Handling Procedures

Please observe the following precautions to avoid damage:

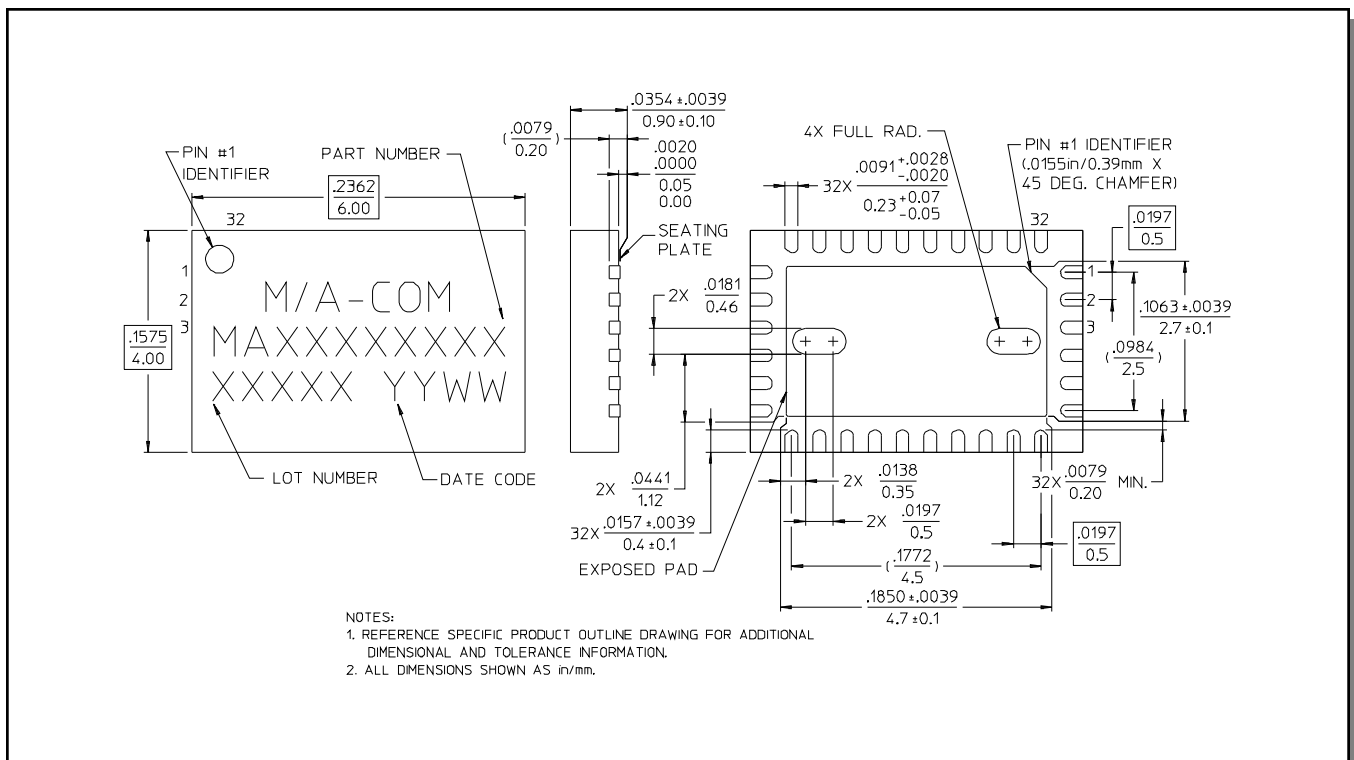
### Static Sensitivity

Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

### Moisture Sensitivity

The MSL rating for this part is defined as Level 2 per IPC/JEDEC J-STD-020. Parts shall be stored and/or baked as required for MSL Level 2 parts.

### CSP-6, 4 x 6 mm, 32-lead, PQFN<sup>†</sup>



<sup>†</sup> Reference Application Note M538 for lead-free solder reflow recommendations.