

## Features

- Operation Bands 1.90 to 2.02 GHz & 1.94 to 2.34 GHz
- Low Amplitude Ripple
- Linear Phase
- 50 ohm nominal impedance
- Continuously Variable Across a Full 360 degree range
- Test Boards to be Available
- Lead-Free 4x6 mm PQFN Package
- 100% Matte Tin Plating over Copper
- Halogen-Free “Green” Mold Compound
- 260°C Reflow Compatible
- RoHS\* Compliant Version of MAMDCC0006

## Description

M/A-COM's MAIA-007143-000100 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. MAIA-007143-000100 is ideally suited for wireless infrastructure applications.

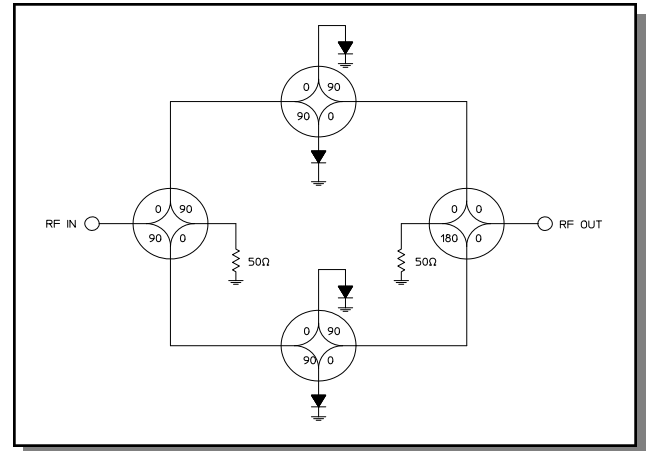
M/A-COM's MADR-007131-000100 Dual Linearizer is designed to simplify the control of Vector Modulators. See Figure 1 and App Note AN3001.

## Ordering Information

Part Number	Package
MAIA-007143-000100	Bulk Packaging
MAIA-007143-0001TR	1000 piece reel
MAIA-007143-0001TB	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)

\* Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

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

Parameter	Test Conditions	Frequency	Units	Min	Typ	Max
Impedance	—	—	$\Omega$	—	50	—
Reference Loss <sup>2</sup>	Z = 50 ohms	1.90 - 2.02 GHz 2.04 - 2.24 GHz	dB dB	-16 -12.5	— —	-11 -10
Attenuation Range	Z = 50 ohms	1.90 - 2.34 GHz	dB	10	—	—
Phase Shift Range	Z = 50 ohms	1.90 - 2.34 GHz	deg	0	—	360
Amplitude Ripple	Z = 50 ohms, Ref Loss	2.08 - 2.20 GHz	dB	—	$\pm 0.06$	$\pm 0.15$
	Z = 50 ohms, 5 dB above Ref Loss	2.08 - 2.20 GHz	dB	—	$\pm 0.10$	$\pm 0.20$
	Z = 50 ohms, 10 dB above Ref Loss	2.08 - 2.20 GHz	dB	—	$\pm 0.14$	$\pm 0.25$
Amplitude Ripple	Z = 50 ohms, Ref Loss	2.04 - 2.24 GHz	dB	—	$\pm 0.09$	$\pm 0.25$
	Z = 50 ohms, 5 dB above Ref Loss	2.04 - 2.24 GHz	dB	—	$\pm 0.15$	$\pm 0.33$
	Z = 50 ohms, 10 dB above Ref Loss	2.04 - 2.24 GHz	dB	—	$\pm 0.20$	$\pm 0.40$
Amplitude Ripple	Z = 50 ohms, Ref Loss	1.90 - 2.02 GHz	dB	—	$\pm 0.06$	$\pm 0.35$
	Z = 50 ohms, 5 dB above Ref Loss	1.90 - 2.02 GHz	dB	—	$\pm 0.10$	$\pm 0.45$
	Z = 50 ohms, 10 dB above Ref Loss	1.90 - 2.02 GHz	dB	—	$\pm 0.14$	$\pm 0.50$
Deviation from Linear Phase	Z = 50 ohms, Ref Loss	2.08 - 2.20 GHz	deg	—	—	$\pm 0.5$
	Z = 50 ohms, 5 dB above Ref Loss	2.08 - 2.20 GHz	deg	—	—	$\pm 1.0$
	Z = 50 ohms, 10 dB above Ref Loss	2.08 - 2.20 GHz	deg	—	—	$\pm 1.5$
Deviation from Linear Phase	Z = 50 ohms, Ref Loss	2.04 - 2.24 GHz	deg	—	—	$\pm 1.0$
	Z = 50 ohms, 5 dB above Ref Loss	2.04 - 2.24 GHz	deg	—	—	$\pm 1.5$
	Z = 50 ohms, 10 dB above Ref Loss	2.04 - 2.24 GHz	deg	—	—	$\pm 2.0$
Deviation from Linear Phase	Z = 50 ohms, Ref Loss	1.90 - 2.02 GHz	deg	—	—	$\pm 1.0$
	Z = 50 ohms, 5 dB above Ref Loss	1.90 - 2.02 GHz	deg	—	—	$\pm 1.2$
	Z = 50 ohms, 10 dB above Ref Loss	1.90 - 2.02 GHz	deg	—	—	$\pm 1.2$
Return Loss	Over 10 dB Attenuation Range	2.04 - 2.24 GHz	dB	15	—	—
		1.90 - 2.20 GHz	dB	8	—	—
Input $IP_3$	Over 10 dB Attenuation Range	1.90 - 2.24 GHz	dBm	—	+41	—
Input $P_{1dB}$	Over 10 dB Attenuation Range	1.90 - 2.24 GHz	dBm	—	+29	—
Noise Figure	Over 10 dB Attenuation Range	1.90 - 2.24 GHz	dB	—	Note 1	—
Control Bandwidth	Output Modulation Lowered 3 dB	—	MHz	—	3.5	—

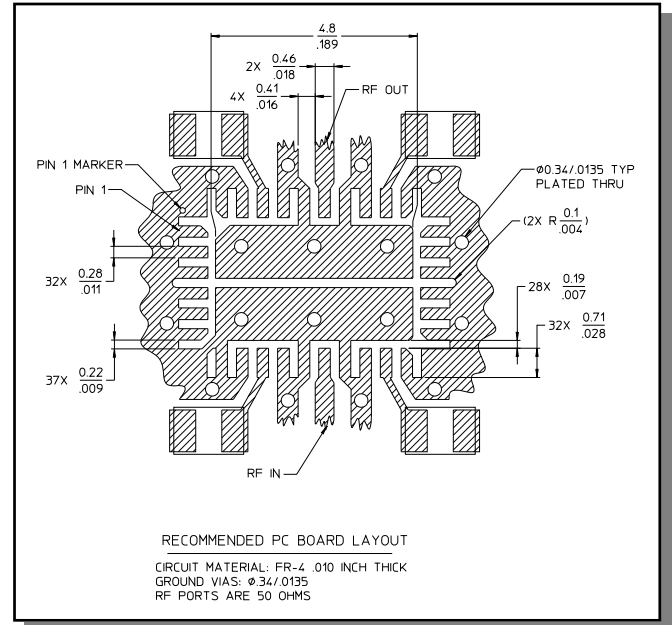
- Noise figure is approximately equal to the absolute attenuation.
- Reference loss is defined as the minimum loss where all phases from  $0^\circ$  to  $360^\circ$  can be realized. Reference loss can be reached with currents of less than 25 mA on Bias 1 and Bias 2.

## Absolute Maximum Ratings <sup>3,4</sup>

Parameter	Absolute Maximum
Max. Input Power 1.5 to 2.0 GHz Other Frequencies	+34 dBm +24 dBm
DC Voltages <sup>5</sup> Vbias1 or Vbias2	+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.

## Recommended PCB Configuration



## Handling Procedures

Please observe the following precautions to avoid damage:

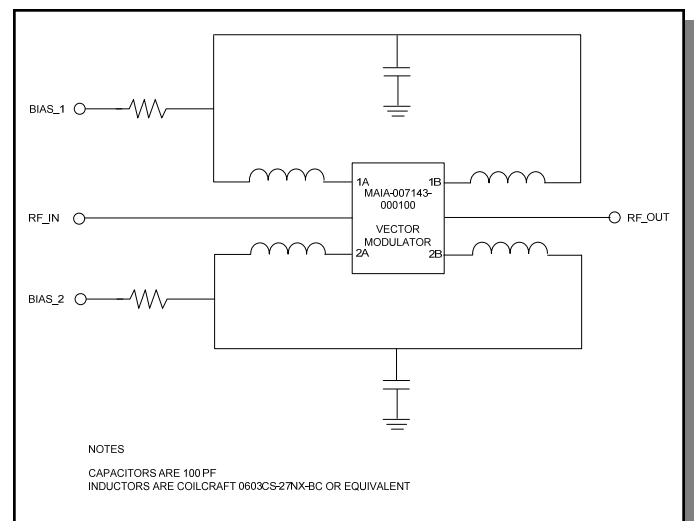
## Static Sensitivity

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

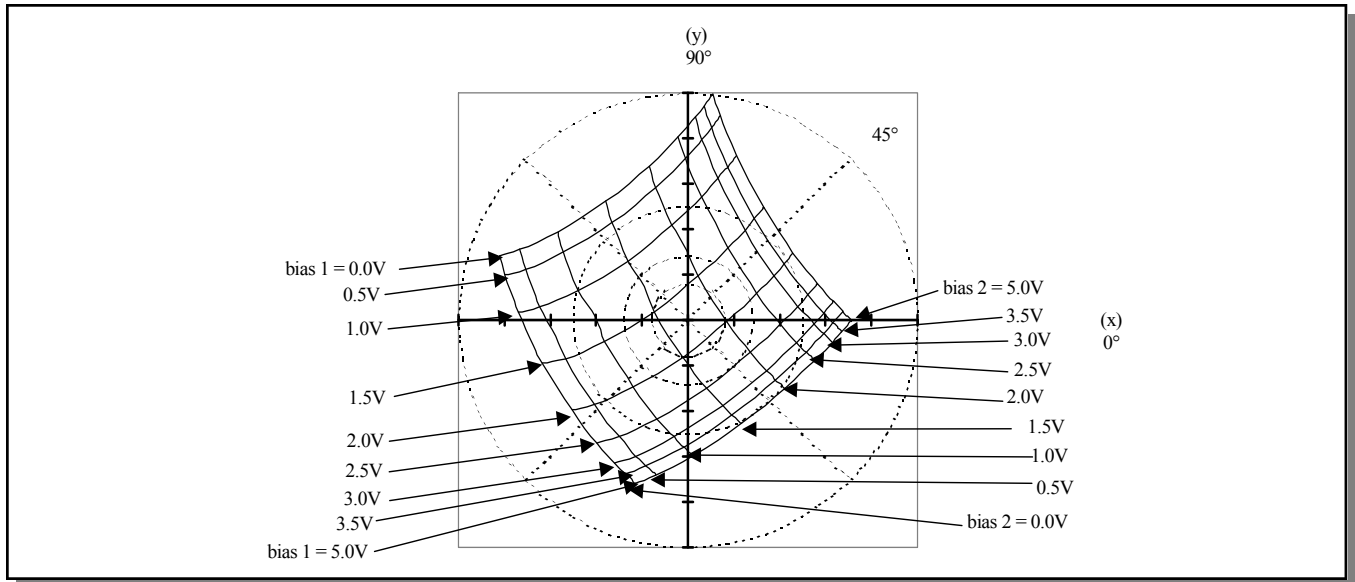
The MSL rating for this part is defined as Level 2 per IPC/JEDEC J-STD-020. Parts shall be stored and/or baked as required for MSL Level 2 parts.

## Schematic with Off-Chip Components

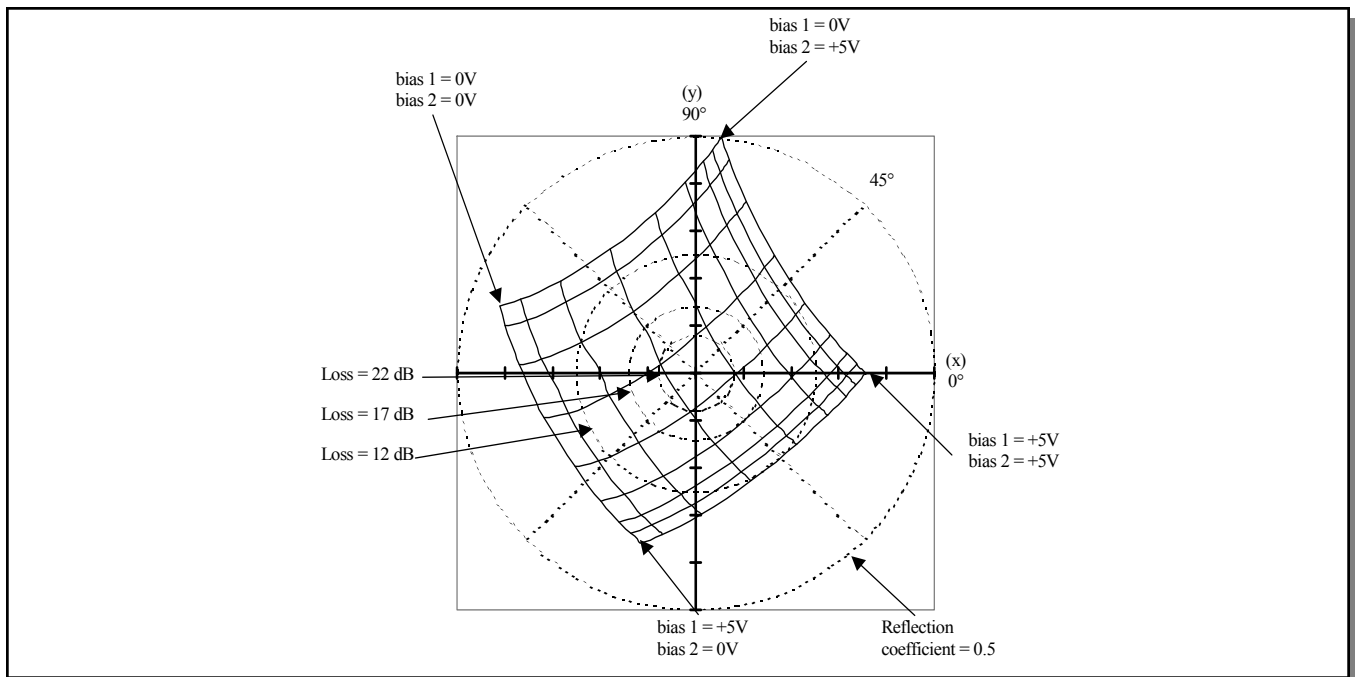


**Phase and Attenuation of MAIA-007143-000100, Vector Modulator Linearized with MADR-007131-000100 Dual Linearizer<sup>6,7,8,9</sup>**

**Figure 1A**



**Figure 1B**



6. Tic marks on x,y axes refer to reflection coefficient in increments of 0.1V. Reflection coefficients vary from -0.5 to +0.5 on both the x and y axes.
7. Data is for vector modulators driven by linearizers per attached schematic.
8. Inputs to the linearizers vary from 0 to 5V.
9. The phase with the inputs to both linearizers set to +5V is arbitrarily called zero degrees.

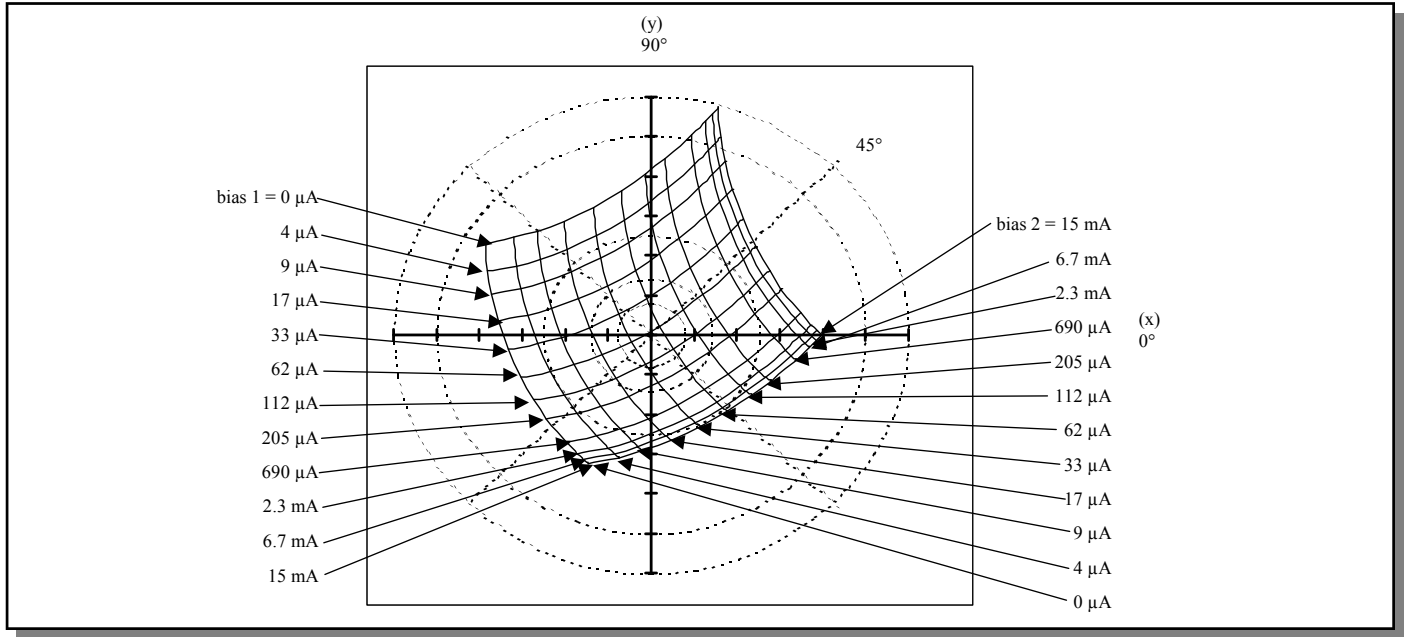
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 Visit [www.macomtech.com](http://www.macomtech.com) for additional data sheets and product information.

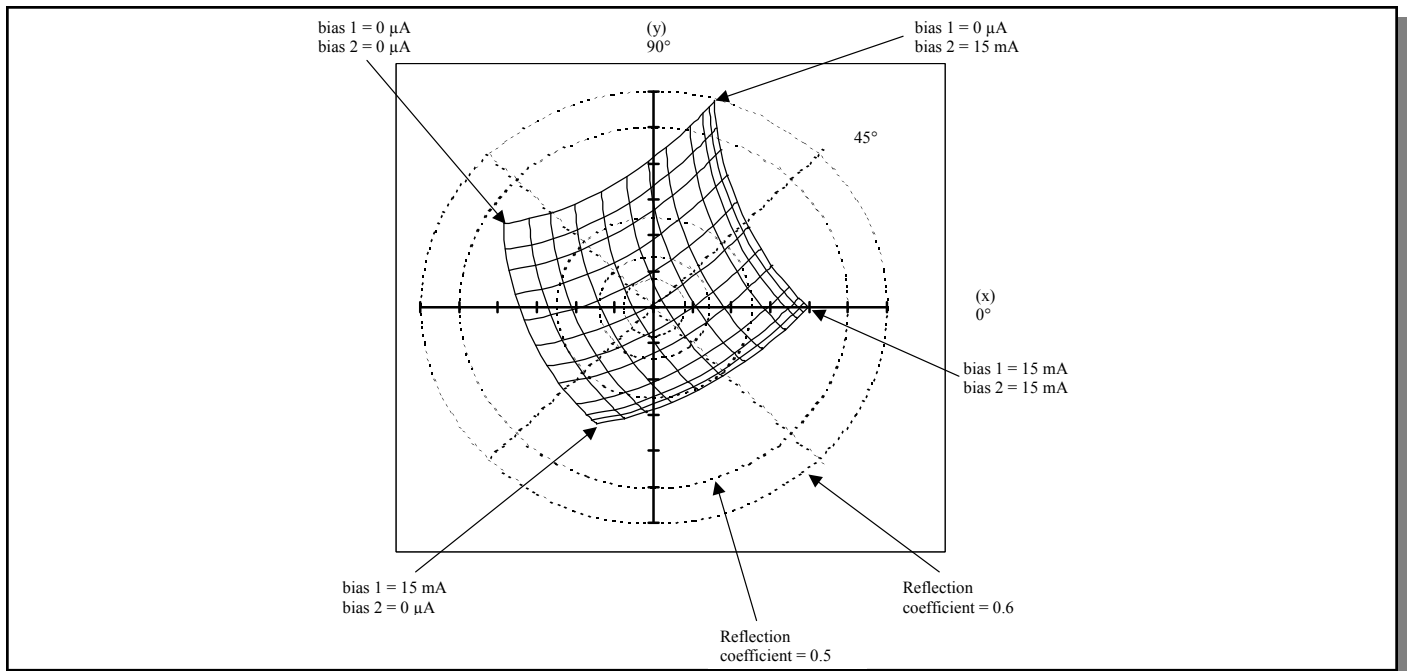
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**Phase and Attenuation of MAIA-007143-000100 vs. Bias Current<sup>10,11</sup>**

**Figure 2A**

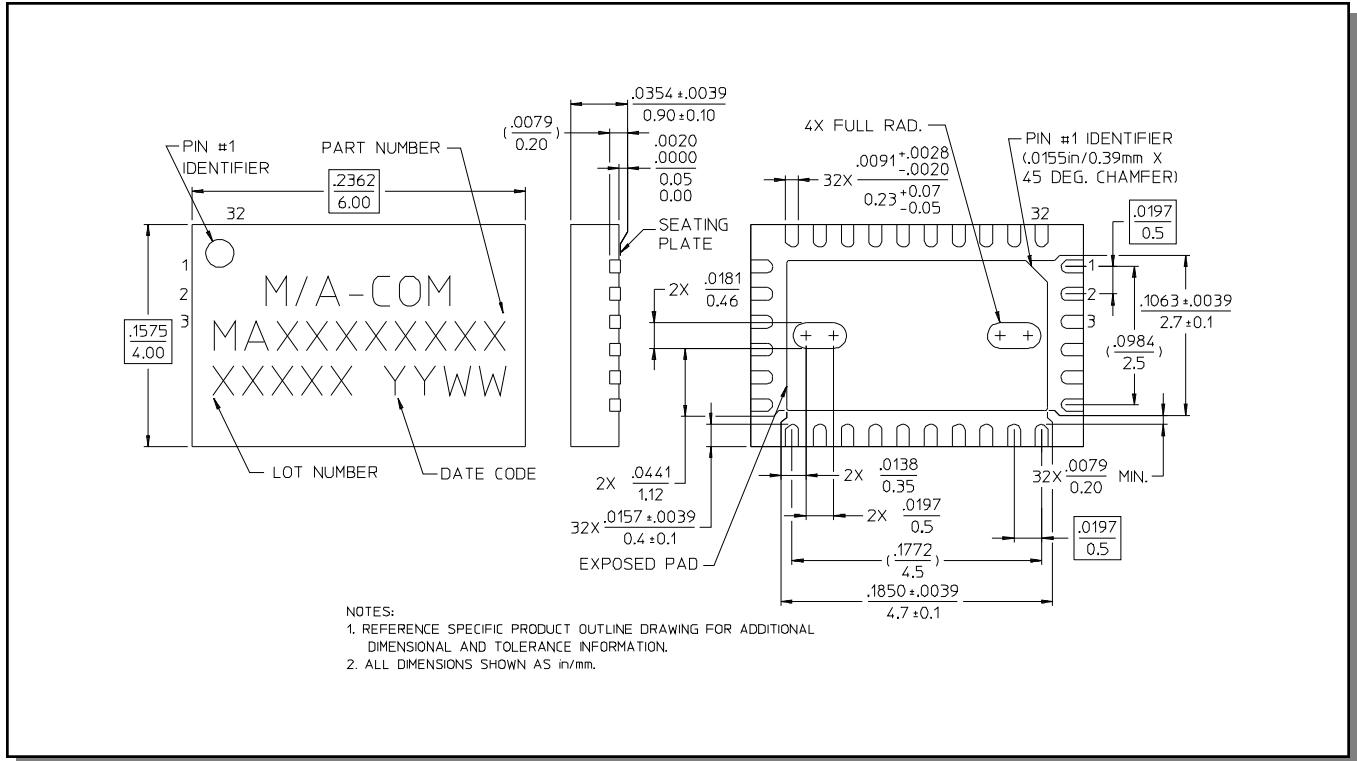


**Figure 2B**



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

## CSP-6, Lead-Free, 4 x 6 mm, 32-lead, PQFN†



† Reference Application Note M538 for lead-free solder reflow recommendations.