Dual Linear Driver for Vector Modulators

V 2.00

MADRCC0002

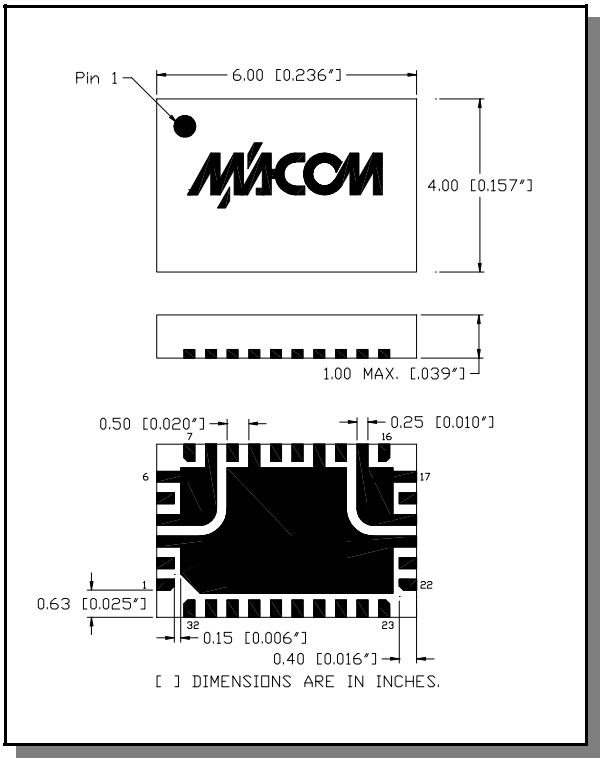
Features

- Linearizes M/A-COM's PIN Diode Vector Modulators Over a 360° Phase Range
- Dual Channels Allow One Driver per Vector Modulator
- Output Currents up to 12 mA
- Operates with a Single Supply Voltage of +5V
- Low Quiescent Currents
- Single Control Voltage for Each Channel
- 6 x 4 mm Chip Scale Package
- Test Boards with Vector Modulators are Available
- Tape and Reel Packaging Available

Description

M/A-COM's MADRCC0002 is a dual, break point free driver that produces a logarithmic output current suitable for linearizing PIN diode based vector modulators. This driver, in conjunction with the external components, as defined in Figure 1, produces a linearized transfer function between the input control voltage of the driver and the attenuation / phase output of the vector modulator. The MADRCC0002 has been optimized for linearizing M/A-COM's Vector Modulators (see Table 1), but will function well with most types of cathode grounded vector modulators. The driver is packaged in a 6 x 4 mm Chip Scale Package for commercial SMT applications. A typical schematic for a dual linearizer driving a vector modulator is shown in Figure 1.

CSP-9



Circuit Description:

(Reference Figures 1, 2 and 3)

Note that this is a dual driver. Only the top circuit will be described, because the bottom circuit is identical. The input divider, R1 and the sum of R2 and R3, sets the overall transfer function of the circuit. To increase the transfer function, decrease the Control Voltage and the value of R1. Temperature compensation is a function of the temperature coefficient of the thermistor, R3, and the ratio of R2 to R3, and can only be optimized once the transfer function and linearity component values have been established. Varying the value of R4 will optimize the linearity of the VVA. One can achieve a more linear transfer function by driving the attenuator over a smaller portion of its dynamic range. Note that when the vector modulators called out in Table 1 are driven with the dual linearizer, both amplitude and phase are affected, which makes it hard to define linearity. The individual transfer function of each voltage variable attenuator in the vector modulator (See Figure 2 for the block diagram) is linearized as a function of voltage. The two VVAs in the block diagram are the quad hybrids that are terminated by two PIN diodes. See Figure 3 for the transfer function of the SA90-0001 vector modulator (phase and attenuation vs. control voltages).

Absolute Maximum Ratings [1]

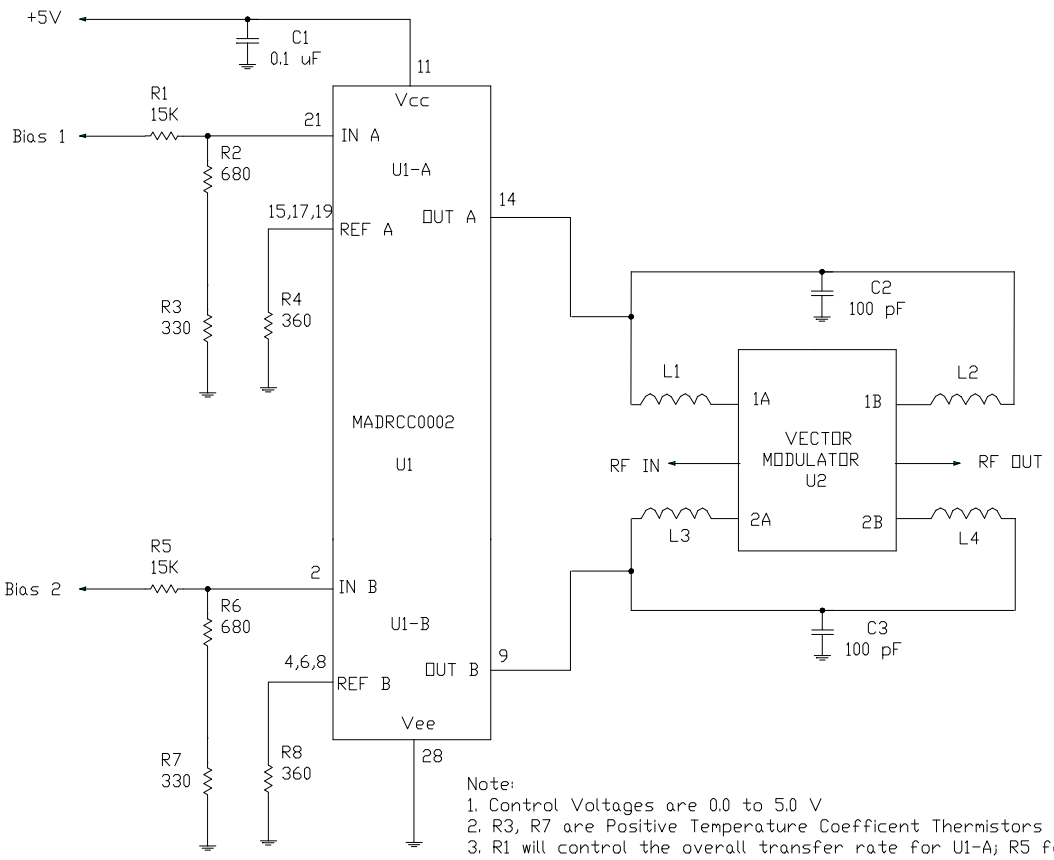
Parameter	Absolute Maximum
$+V_{CC}$	+20 V
IN A, IN B	-0.5V ≤ Input ≤ Vcc +0.5V
REF A, REF B	-0.5V ≤ Input ≤ Vcc +0.5V
Output Short Circuit Current	20 mA
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +125°C
Package Power Dissipation Control Voltage	150 mW
Lead Temperature	300ºC for 10 seconds

1. Operation of this device above any one of these parameters may cause permanent damage.

Electrical Specifications, T_A = +25°C, Reference Figure 1 (Each Circuit)

Parameter	Test Conditions	Units	Min	Typical	Max
Output Drive Current	Vcontrol = V_{CC}	mA	18	—	—
+V_{CC} Supply Range	—	V	4.5	5.0	5.5
IN, REF Voltage	—	V	0	—	V_{CC}
+V_{CC} Quiescent Current	No Load	µA	—	50	70
Settling Time	50% Ctl to 90%/10% RF	µS	—	25	—

Figure 1



Note:
1. Control Voltages are 0.0 to 5.0 V
2. R3, R7 are Positive Temperature Coefficent Thermistors
3. R1 will control the overall transfer rate for U1-A; R5 for U1-B.
4. R4 will control the ripple of the tranfer rate for U1-A; R8 for U1-B.
5. Unmarked Pins are to be left open
6. Resistor Tolerance is ± 2%
7. See Table 1 for inductor values

Specifications subject to change without notice.

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Figure 3A - Phase and Attenuation of SA90-0001, Vector Modulator Linearized with MADRCC0002 Linearizer

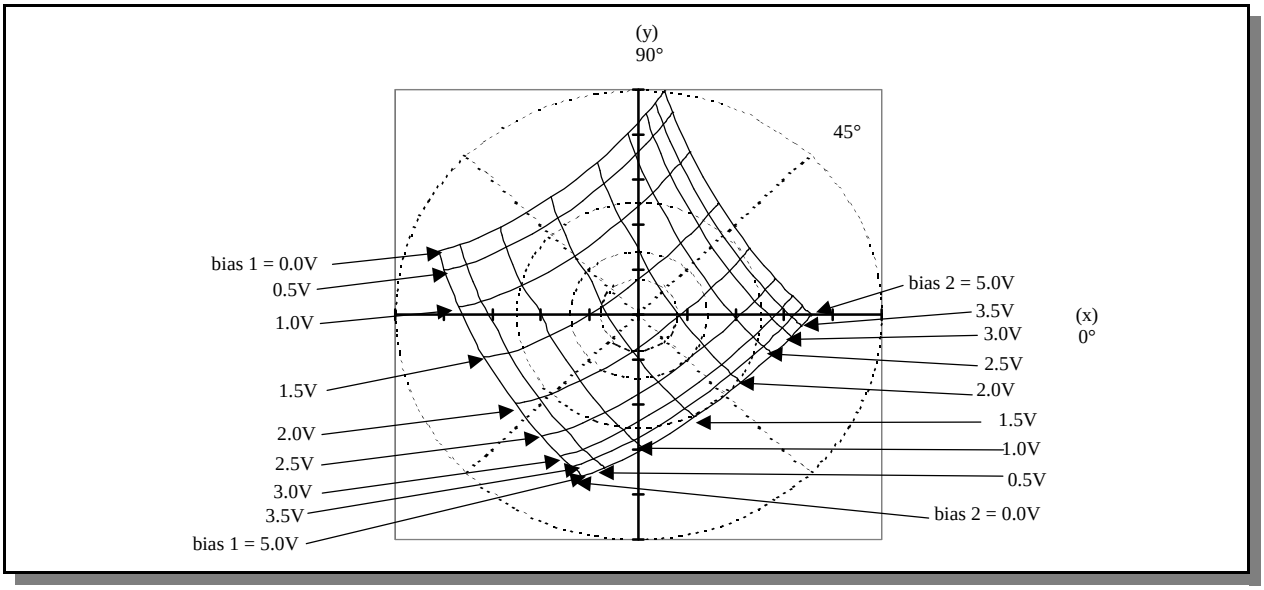
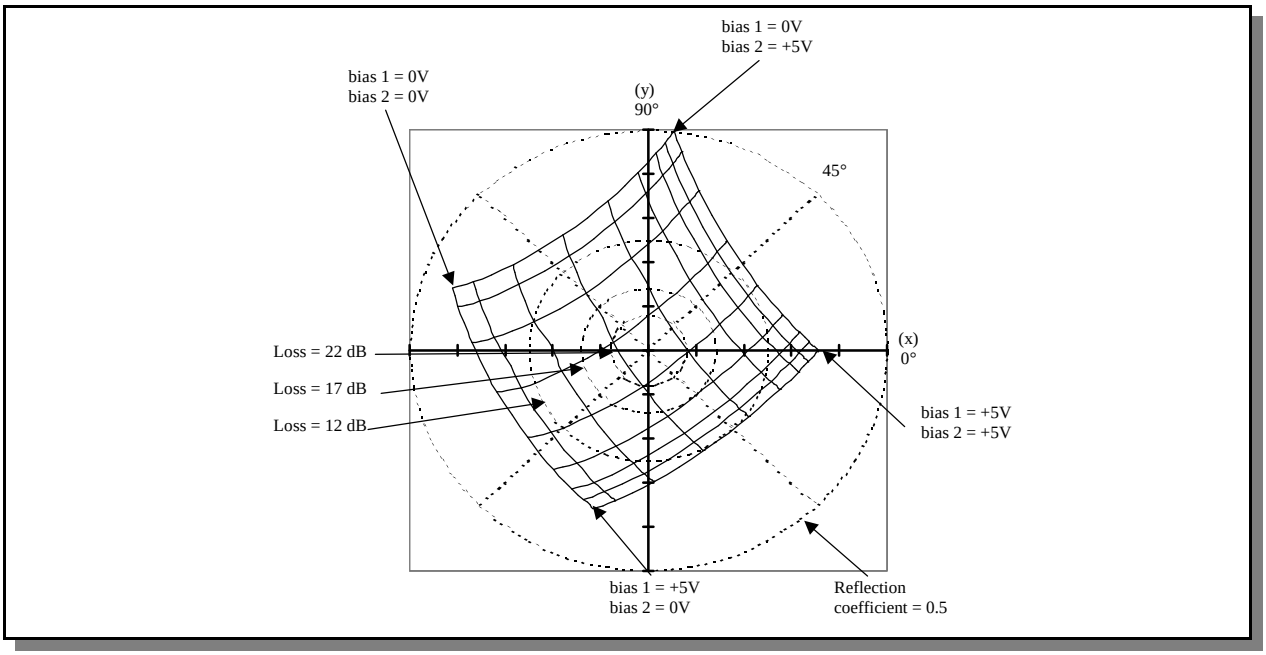


Figure 3B



2. 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.
3. Data is for vector modulators driven by linearizers per attached schematic.
4. Inputs to the linearizers vary from 0 to 5V.
5. The phase with the inputs to both linearizers set to +5V is arbitrarily called zero degrees.

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Table 1. Inductor Selection for M/A-COM Vector Modulators

Vector Modulator	Frequency Range (MHz)	Coil Craft P/N L1 & L2	Description of L1 & L2
MAMDCC0005	925-960 (GSM)	0603CS-68NXJBC	Inductor, 68 nH, ± 5%
MAMDCC0002	1930-1990 (PCS)	0603CS-27NXJBC	Inductor, 27 nH, ± 5%
SA90-0001	2040-2240 (UMTS)	0603CS-27NXJBC	Inductor, 27 nH, ± 5%

Recommended PCB Layout [6]

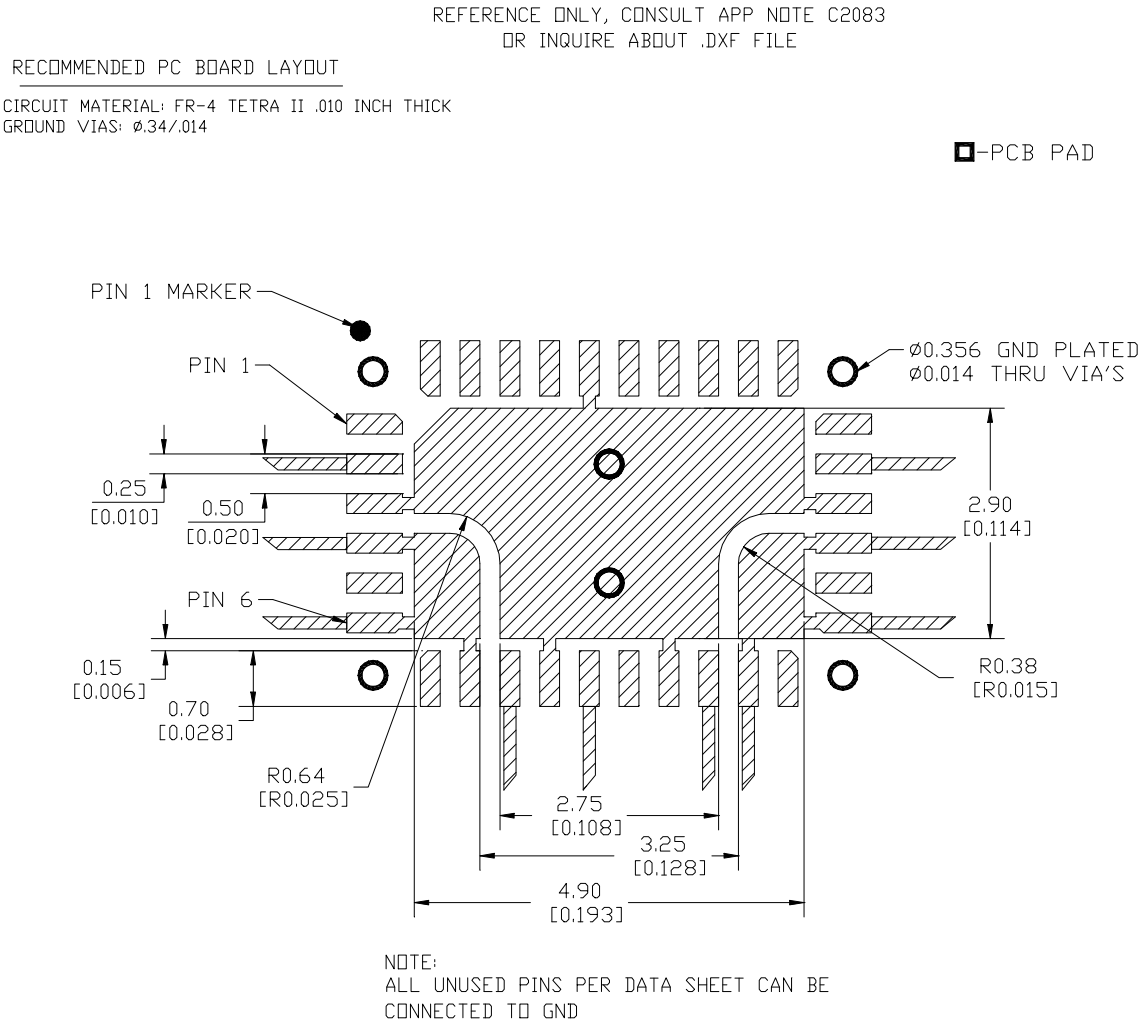
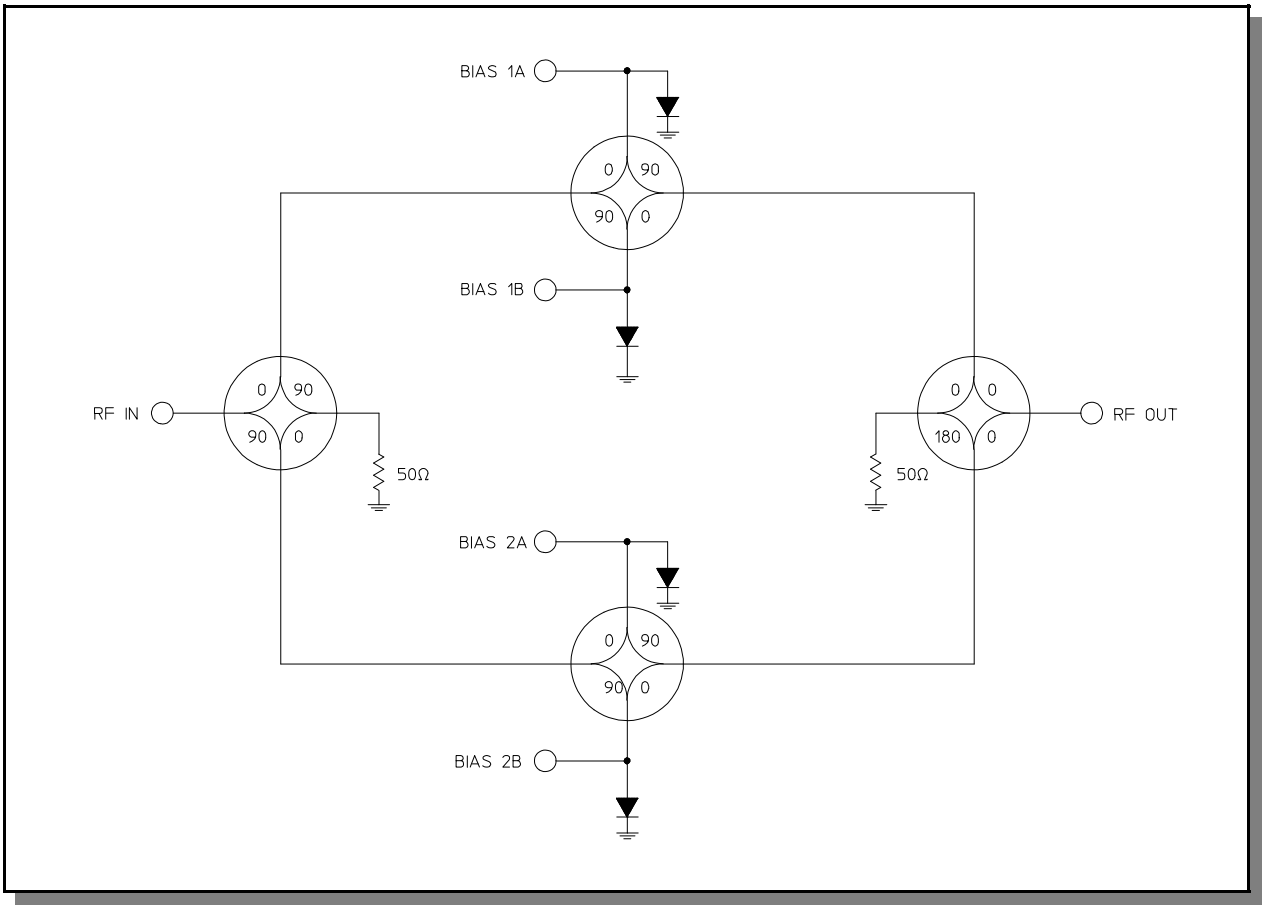


Figure 2—Block Diagram
Vector Modulator



Ordering Information

Part Number	Package
MADRCC0002	Bulk Packaging
MADRCC0002TR	Tape & Reel (1K Reel)
MAMDCC0005-DC000	Test Board with Circuit per Figure 1 (MAMDCC0005, GSM Vector Modulator)
MAMDCC0002-DC000	Test Board with Circuit per Figure 1 (MAMDCC0002, PCS Vector Modulator)
SA90-0001-DC000	Test Board with Circuit per Figure 1 SA90-0001, UMTS Vector Modulator

Pin Configuration

Pin #	Function	Pin #	Function
1	NC	17	REF A
2	IN B	18	NC
3	NC	19	REF A
4	REF B	20	NC
5	NC	21	IN A
6	REF B	22	NC
7	NC	23	NC
8	REF B	24	NC
9	OUT B	25	NC
10	NC	26	NC
11	Vcc	27	NC
12	NC	28	GND
13	NC	29	NC
14	OUT A	30	NC
15	REF A	31	NC
16	NC	32	NC

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