SA90-0001

Vector Modulator, 1.94 to 2.24 GHz

Rev. V6

Features

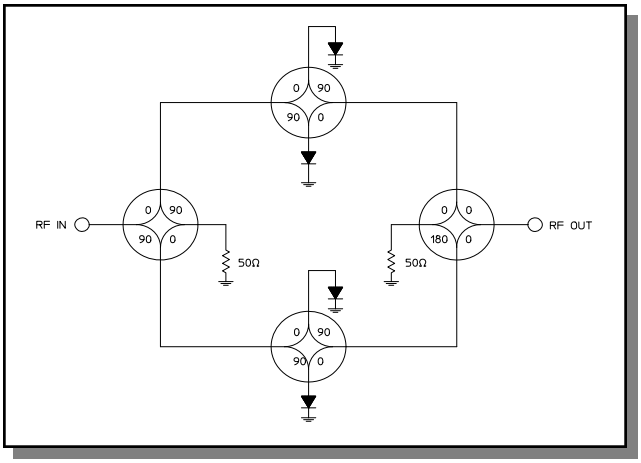
- Operates 1.94 to 2.24 GHz
- Low Amplitude Ripple
- Linear Phase
- 50 Ohm nominal impedance
- Continuously Variable Across a Full 360 degree range
- Test Boards Available
- 4x6 mm PQFN Package

Description

M/A-COM's SA90-0001 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. SA90-0001 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.

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)

Ordering Information

Part Number	Package
SA90-0001	Bulk Packaging
SA90-0001TR	1000 piece reel
SA90-0001--DC000	Sample Test Board

Note: Reference Application Note M513 for reel size information.

• **North America** Tel: 800.366.2266 • **Europe** Tel: +353.21.244.6400
• **India** Tel: +91.80.4155721 • **China** Tel: +86.21.2407.1588
Visit www.macomtech.com for additional data sheets and product information.

Vector Modulator,
1.94 to 2.24 GHz

Rev. V6

Electrical Specifications: T_A = 25°C, Z_0 = 50Ω

Parameter	Test Conditions	Frequency	Units	Min	Typ	Max
Impedance	—	—	Ω	—	50	—
Reference Loss	Z = 50Ω	1.94—2.34 GHz	dB	-13.5	—	-10.0
Attenuation Range	Z = 50Ω Above Reference Loss	1.94—2.34 GHz	dB	10	—	—
Phase Shift Range	Z = 50Ω, Over minimum Attenuation Range	1.94—2.34 GHz	deg	0	—	360
Amplitude Ripple	Z = 50Ω, Ref Loss Z = 50Ω, 5 dB above Ref Loss Z = 50Ω, 10 dB above Ref Loss Z = 50Ω, Ref Loss Z = 50Ω, 5 dB above Ref Loss Z = 50Ω, 10 dB above Ref Loss	2.08—2.20 GHz 2.08—2.20 GHz 2.08—2.20 GHz 2.04—2.24 GHz 2.04—2.24 GHz 2.04—2.24 GHz	dB dB dB dB dB dB	— — — — — —	— — — — — —	±0.2 ±0.25 ±0.3 ±0.35 ±0.4 ±0.5
Deviation from Linear Phase	Z = 50Ω, Ref Loss Z = 50Ω, 5 dB above Ref Loss Z = 50Ω, 10 dB above Ref Loss Z = 50Ω, Ref Loss Z = 50Ω, 5 dB above Ref Loss Z = 50Ω, 10 dB above Ref Loss	2.08—2.20 GHz 2.08—2.20 GHz 2.08—2.20 GHz 2.04—2.24 GHz 2.04—2.24 GHz 2.04—2.24 GHz	deg deg deg deg deg deg	— — — — — —	— — — — — —	±0.5 ±1.0 ±1.5 ±1.0 ±1.5 ±2.0
Return Loss	Over 10 dB Attenuation Range	2.04—2.24 GHz	dB	15	—	—
Input IP_3	Over 10 dB Attenuation Range	2.04—2.24 GHz	dBm	—	+41	—
Input P_{1dB}	Over 10 dB Attenuation Range	2.04—2.24 GHz	dBm	—	+29	—
Noise Figure	Over 10 dB Attenuation Range	2.04—2.24 GHz	dB	—	—	Note 1
Switching Speed	50% Control to 10%/90% RF	—	ns	—	500	—
I Supply	—	—	mA	—	—	100

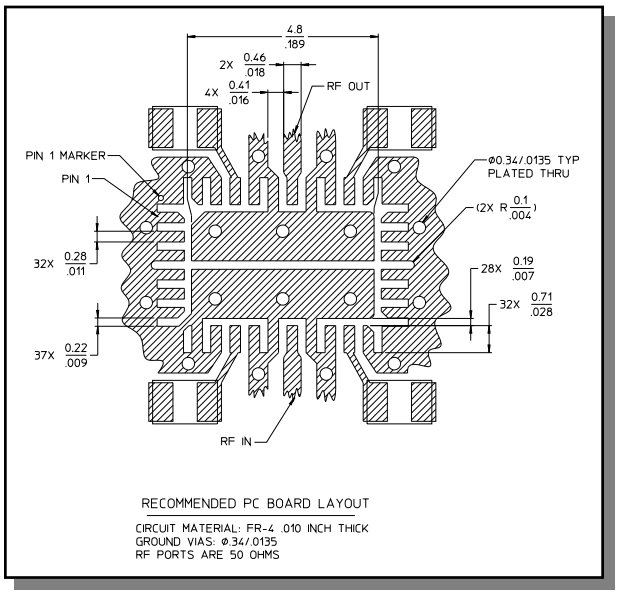
1. Noise figure is approximately equal to the absolute attenuation.

Absolute Maximum Ratings[2,3]

Parameter	Absolute Maximum
Max. Input Power 1.5 t6 2.0 GHz Other Frequencies	 +34 dBm +24 dBm
DC Voltages[4] Vbias1 or Vbasis2	 +1.0V
DC Current	50 mA Max per Bias
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +125°C

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

Recommended PCB Configuration



• **North America** Tel: 800.366.2266 • **Europe** Tel: +353.21.244.6400
• **India** Tel: +91.80.4155721 • **China** Tel: +86.21.2407.1588
Visit www.macomtech.com for additional data sheets and product information.

Phase and Attenuation of SA90-0001, Vector Modulator Linearized with MADRCC0002 Dual Linearizer[5,6,7,8]

Figure 1A

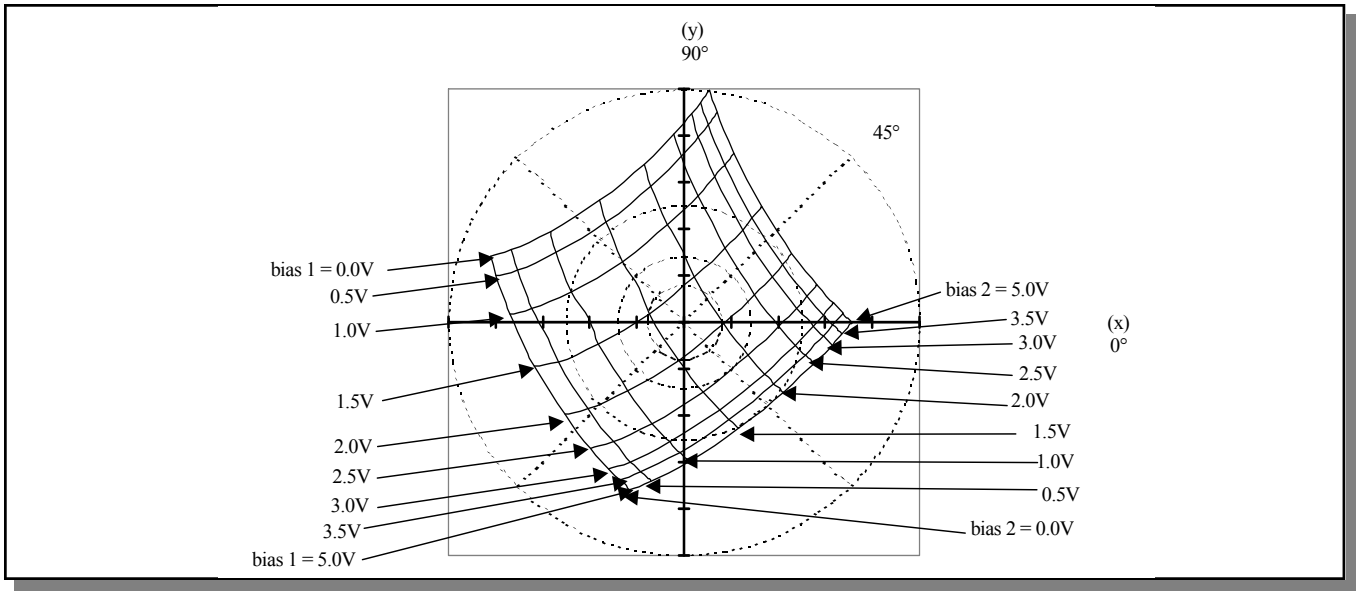
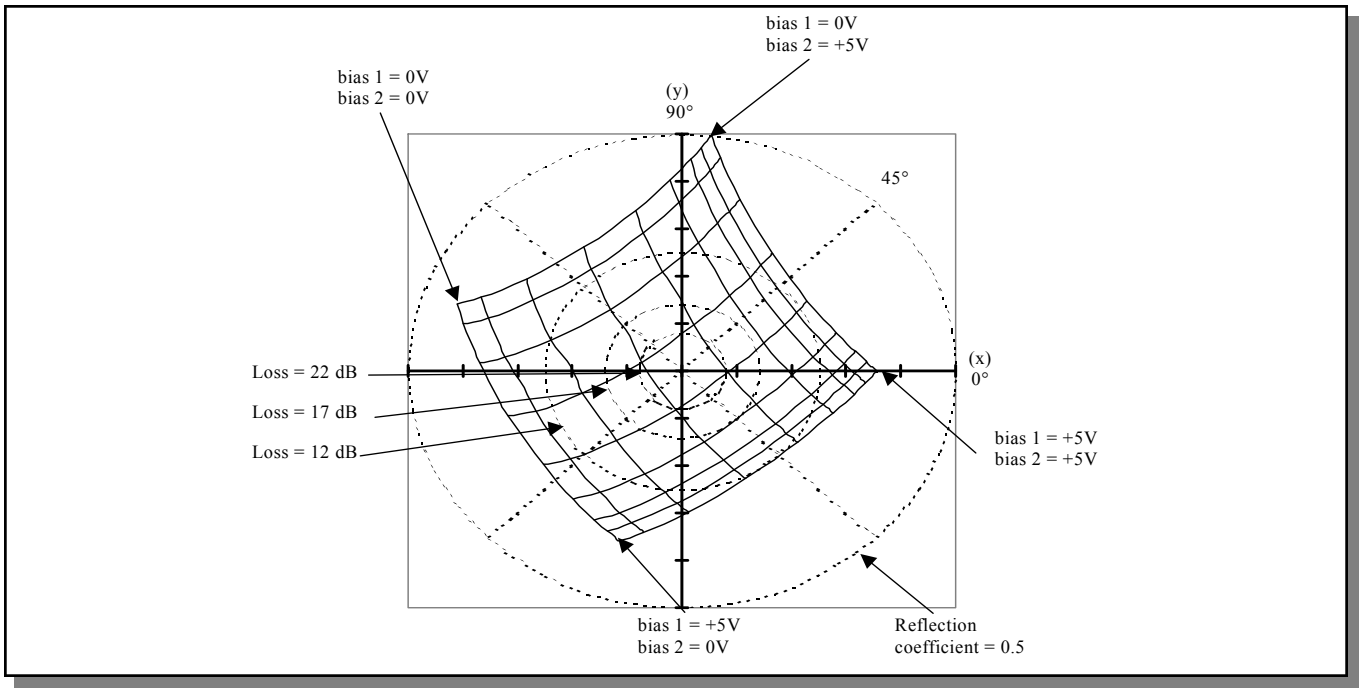


Figure 1B



5. Tic marks on x,y axes refer to reflection coefficient in increments of 0.1V. Reflection coefficients vary from -0.5 to +0.5 on both the x and y axes.
6. Data is for vector modulators driven by linearizers per attached schematic.
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.

• **North America** Tel: 800.366.2266 • **Europe** Tel: +353.21.244.6400
• **India** Tel: +91.80.4155721 • **China** Tel: +86.21.2407.1588
Visit www.macomtech.com for additional data sheets and product information.

Phase and Attenuation of SA90-0001 vs. Bias Current[9,10]

Figure 2A

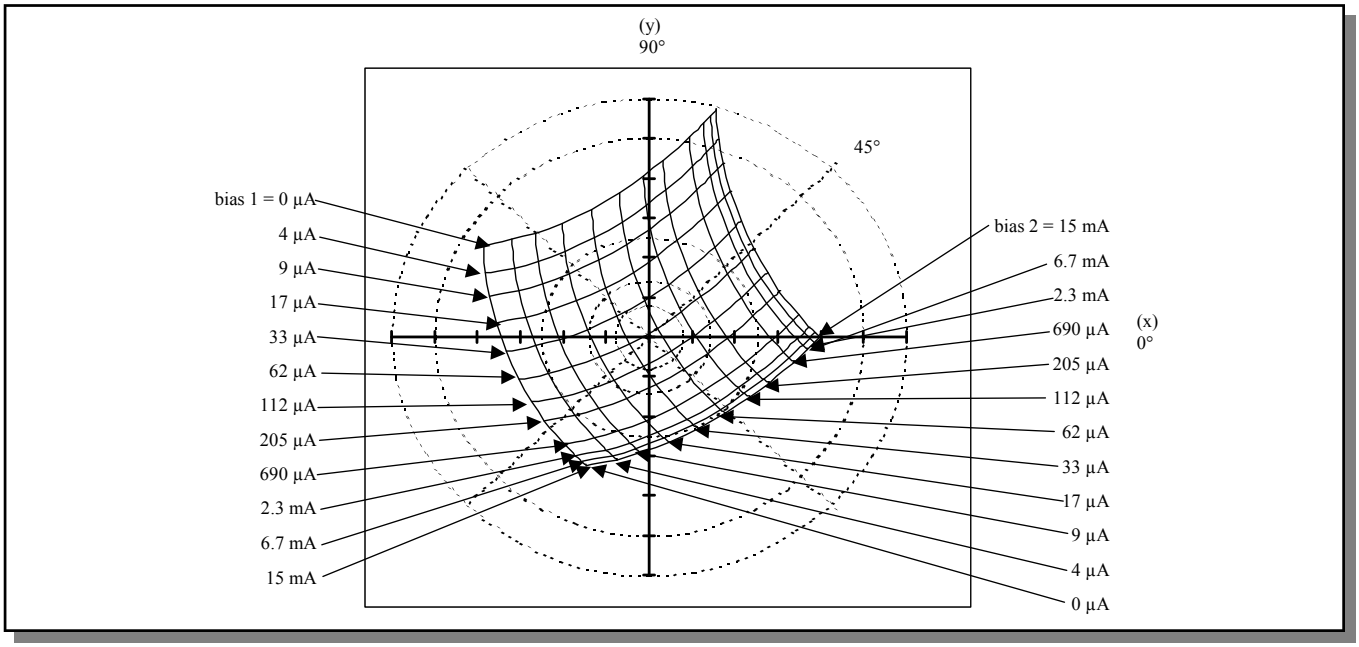
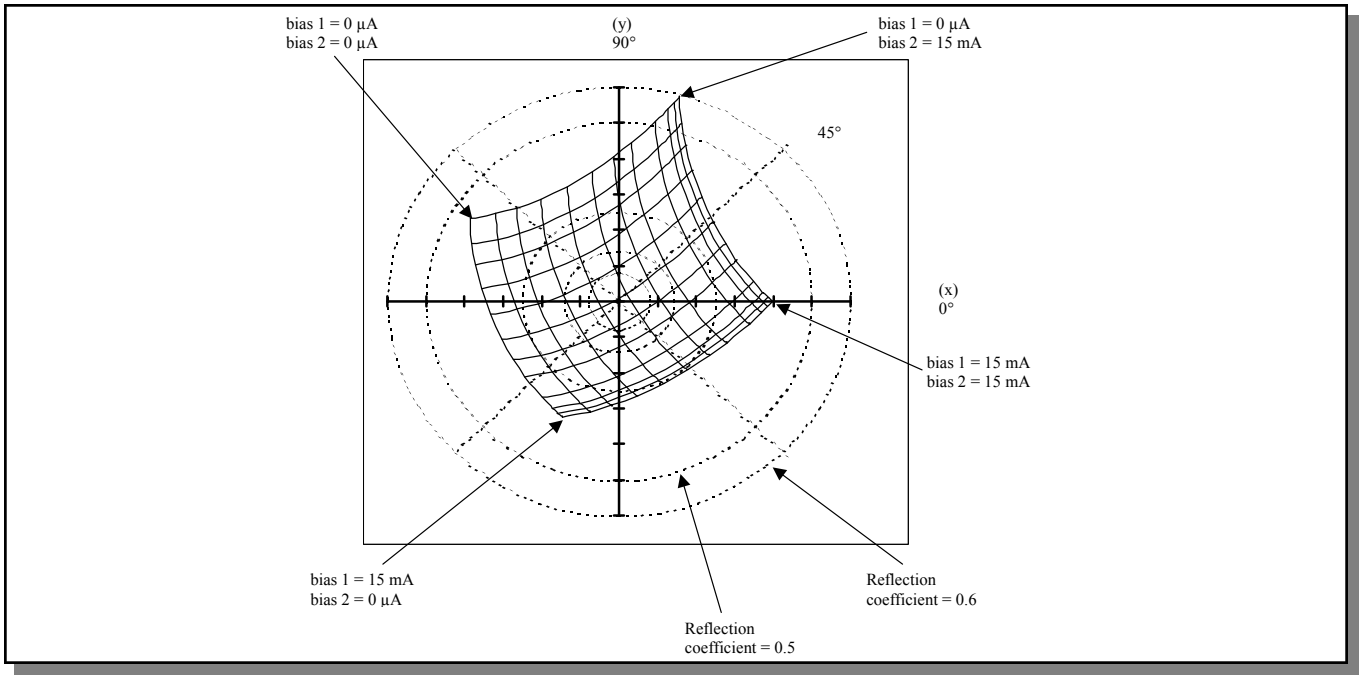


Figure 2B



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 +15mA is arbitrarily called zero degrees.

Handling Procedures

Please observe the following precautions to avoid damage:

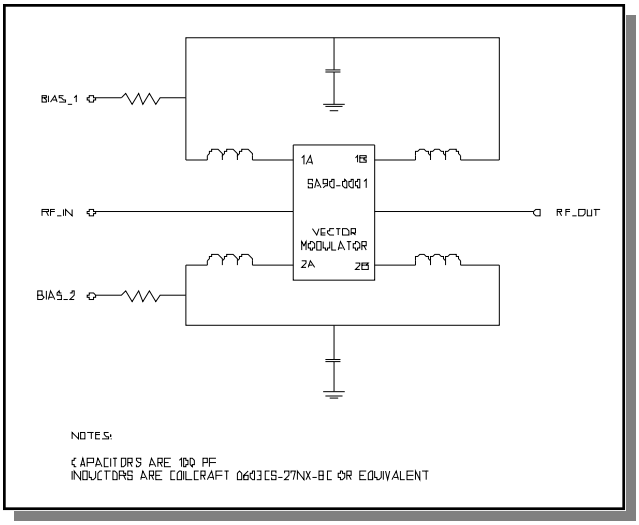
Static Sensitivity

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.

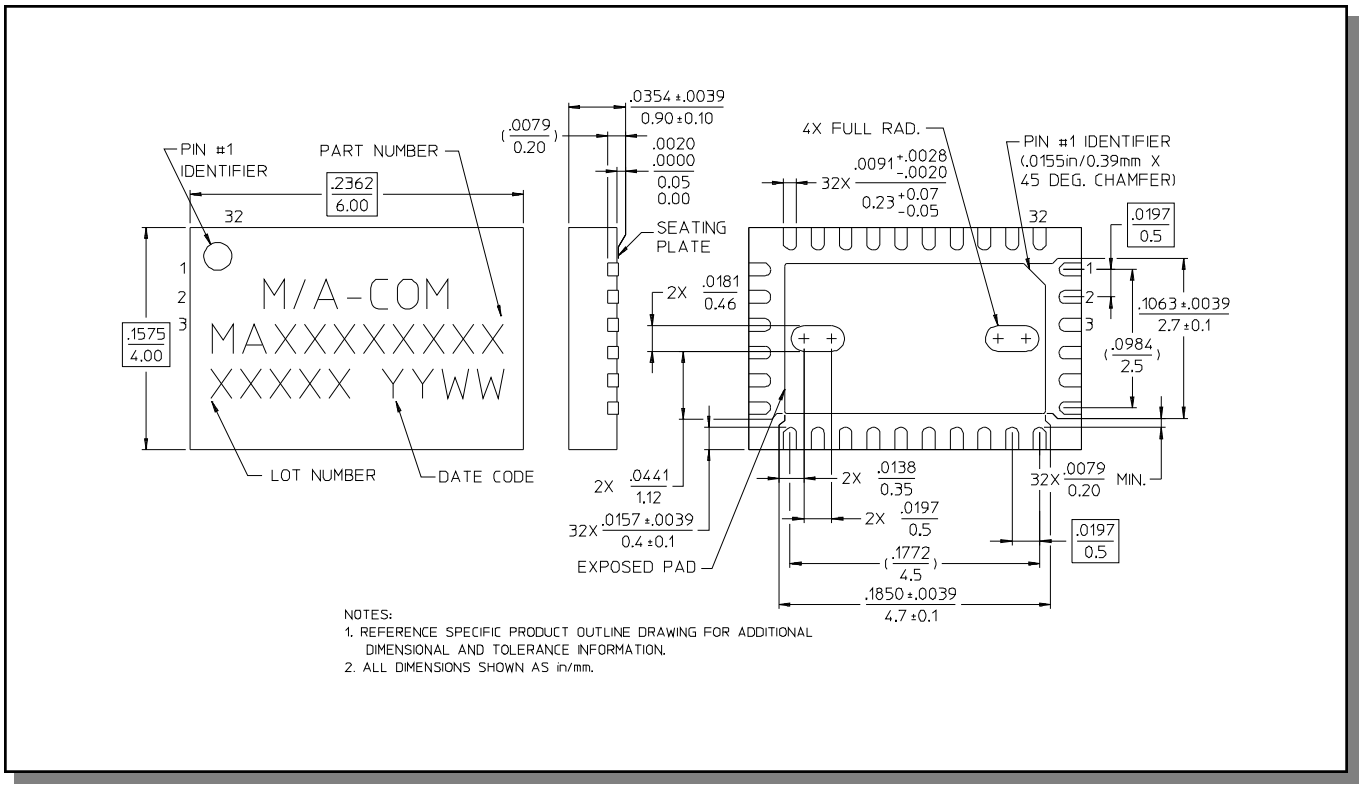
Moisture Sensitivity

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



CSP-6, 4 x 6 mm, 32-lead, PQFN†



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

• **North America** Tel: 800.366.2266 • **Europe** Tel: +353.21.244.6400
• **India** Tel: +91.80.4155721 • **China** Tel: +86.21.2407.1588
Visit www.macomtech.com for additional data sheets and product information.