High Dynamic Range Low Noise Amplifier, 1400 - 2000 MHz

AM50-0004
V3

Features

- Low Noise Figure: 1.4 dB
- High Input IP3: +18 dBm at 8 V, 45 mA bias
  +8 dBm at 3 V, 20 mA bias
- High Gain: 14 dB
- Single Supply: +3 to +8 VDC
- Low Cost SOIC-8 Plastic Package
- Adjustable current: 20 to 60 mA with external resistor

Description

M/A-COM"s AM50-0004 is a high dynamic range, GaAs MMIC, low noise amplifier in a low cost, SOIC 8-lead, surface mount, plastic package. It employs external input matching to obtain optimum noise figure performance and operating frequency flexibility. The AM50-0004 also features flexible biasing to control the current consumption vs. dynamic range trade-off. The AM50-0004 can operate from any positive supply voltage in the 3 V to 8 V range. Its current can be controlled over a range of 20 mA to 60 mA with an external resistor.

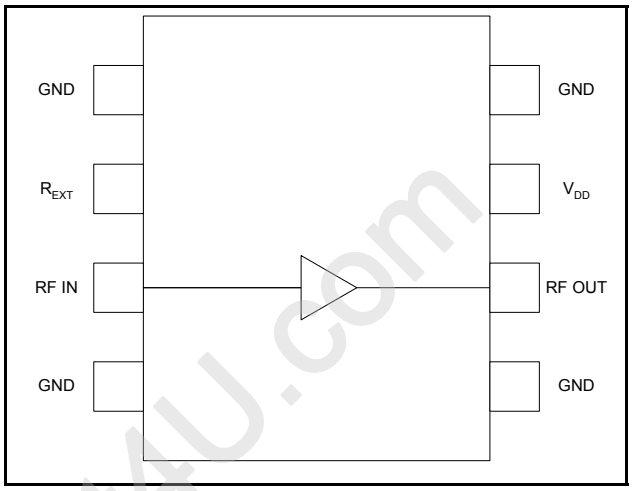
The AM50-0004 is ideally suited for use where low noise figure, high gain, high dynamic range, and low power consumption are required. Typical applications included receiver front ends in PDC, DCS-1800, DCS-1900 and other PCN/PCS base stations. It is also useful as a gain block, buffer, driver, and IF amplifier in both fixed or portable PDC and PCN/PCS systems.

Ordering Information

Part Number	Package
AM50-0004	Bulk Packaging
AM50-0004TR	1000 piece reel
AM50-0004RTR	Reverse Tape and Reel
AM55-0024SMB	Designers Kit

Note: Reference Application Note M513 for reel size information.

Functional Block Diagram



Pin Configuration

Pin No.	Pin Name	Description
1	GND	RF and DC Ground
2	R_{EXT}	External Current Control (optional)
3	IN	RF Input of the amplifier
4	GND	RF and DC Ground
5	GND	RF and DC Ground
6	OUT	RF Output of the amplifier
7	V_{DD}	Positive supply voltage
8	GND	RF and DC Ground

Absolute Maximum Ratings [1]

Parameter	Absolute Maximum
VDD	+10 VDC
Input Power	+10 dBm
Current[2]	80 mA
Channel Temperature[3]	+150°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

1. Exceeding any one or combination of these limits may cause permanent damage.
2. When pin #2 is used to increase current. (see note 6.)
3. Thermal resistance (θjc) = +88°C/W

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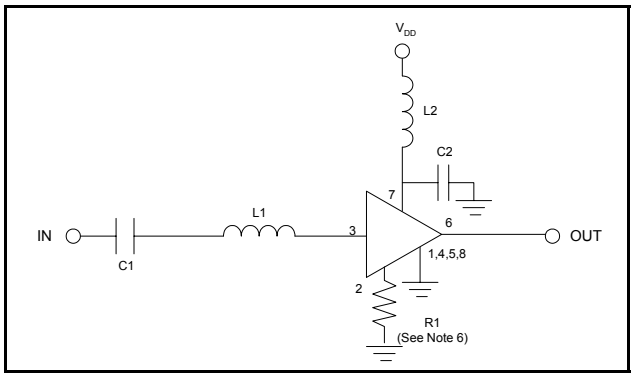
Electrical Specifications: T_A = +25°C, Z_0 = 50 Ohms, F=900 MHz, P_{in} = -30 dBm

Parameter	Test Conditions	Units	Min	Typ	Max
Gain	1400 - 2000 MHz, 5 V, 45 mA[4]	dB	12.0	14	—
	1400 - 2000 MHz, 3 V, 20 mA	dB	—	12.5	—
Noise Figure	1400 - 2000 MHz, 5 V, 45 mA[4]	dB	—	1.4	1.8
	1400 - 2000 MHz, 3 V, 20 mA	dB	—	1.5	—
Input VSWR	1400 - 2000 MHz,	Ratio	—	1.5:1	—
Output VSWR	1400 - 2000 MHz,	Ratio	—	2.0:1	—
Output 1 dB Compression	1400 - 2000 MHz, 5 V, 45 mA[4]	dBm	—	16.0	—
	1400 - 2000 MHz, 3 V, 20 mA	dBm	—	9.0	—
Input IP3	1400 - 2000 MHz, 5 V, 45 mA[4]	dBm	13.0	15	—
	1400 - 2000 MHz, 3 V, 20 mA	dBm	—	8.0	—
Reverse Isolation	1400 - 2000 MHz,	dB	—	22	—
Drain Current	1400 - 2000 MHz, 5 V, 45 mA[4]	mA	30	45	60

4. Using external 15 Ω resistor. See functional block diagram herein.

Functional Schematic



Components List [5]

Part	Value	Case Size	Manufacturer	Purpose
C1	47 pF	0603	Murata	DC Block
C2	47 pf	0603	Murata	By-Pass
L1	3.9 nH	0603	Coilcraft	Tuning
L2	12 nH	0603	Coilcraft	RF Choke
R1	See note 6	0603	Panasonic	Optional current control

5. All External circuitry parts are readily available, low cost surface mount components (.060 in. x .030 in. or .080 in. x .050 in.)
6. Pin 2 allows use of an external resistor to ground for optional, higher current. For 20 mA operation, no resistor is used.
   For IDD ~ 30 mA, R2 = 39 ohms;
   IDD ~ 45 mA, R2 = 15 ohms;
   IDD ~ 60 mA, R2 = 6 ohms.

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.

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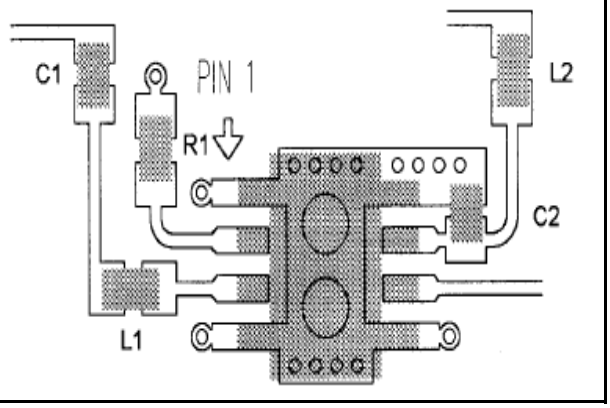
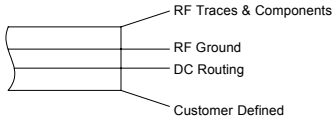
Recommended PCB Configuration

Layout View



Cross Section View

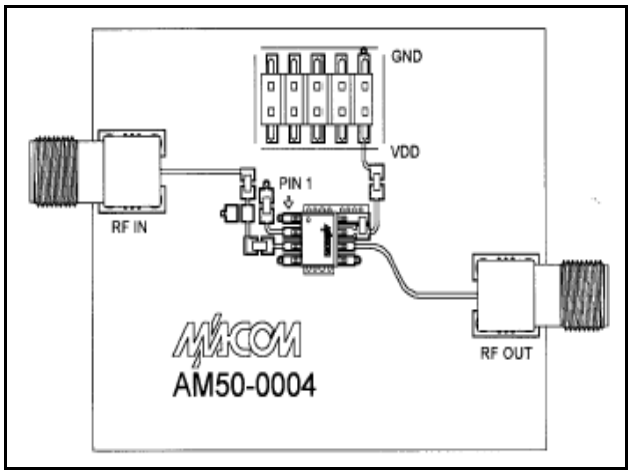


The PCB dielectric between RF traces and RF ground layers should be chosen to reduce RF discontinuities between 50 Ω lines and package pins. M/A-COM recommends an FR-4 dielectric thickness of .008" (0.20 mm) yielding a 50 Ohm line width of 0.015" (0.38 mm). The recommended RF metalization thickness is 1 ounce copper.

Designer's Kit AM50-0004SMB

The AM50-0004SMB Designer's Kit allows for immediate evaluation of M/A-COM's AM50-0004. The Designer's Kit includes an evaluation board with mounted AM50-0004 and five loose AM50-0004's. The evaluation board consists of the recommended external surface mount circuitry, RF connectors, and a DC multi-pin connector, all mounted to a multi-layer FR-4 PCB. The AM50-0004SMB evaluation PCB is illustrated below with all functional ports labeled.

AM50-0004 Evaluation Board



Evaluation PCB & RF Connector Losses

Port Reference	Approximate RF Loss
RF In	0.15 dB @ 1785 MHz
RF Out	0.15 dB @ 1785 MHz

The DC connector on the Designer's Kit PCB allows convenient DC line access. This is accomplished by the one or more of the following methods.

7. A mating female multi-pin connector (Newark Electronics Stock # 46F-4658, not included).
8. Wires soldered to the necessary pins (not included).
9. Clip leads (not included).

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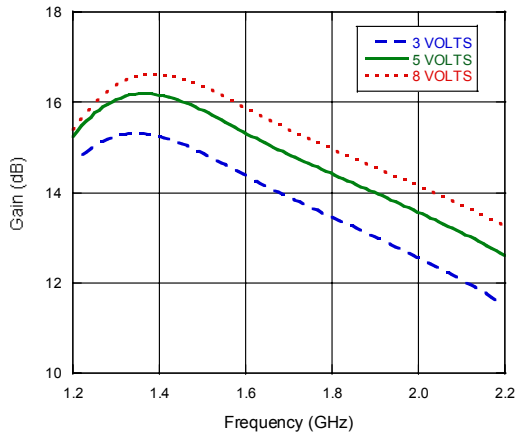
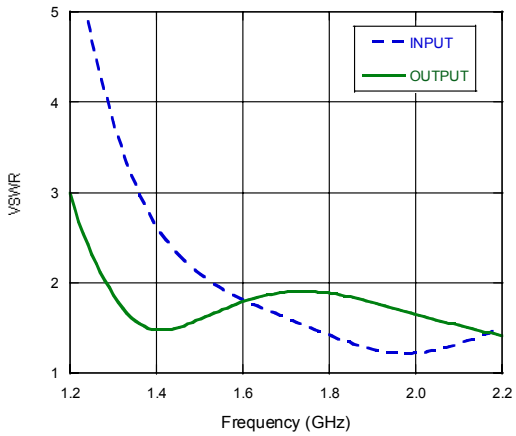
Typical Performance Curves

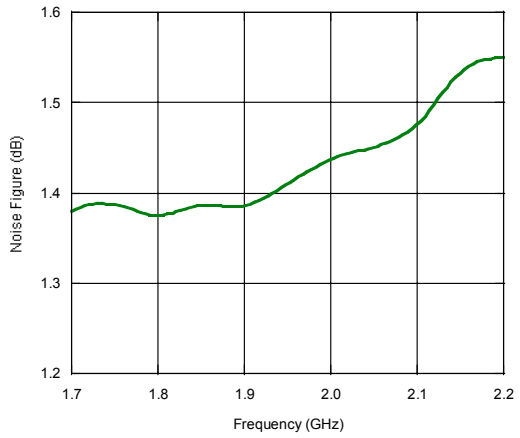
Gain vs. Frequency



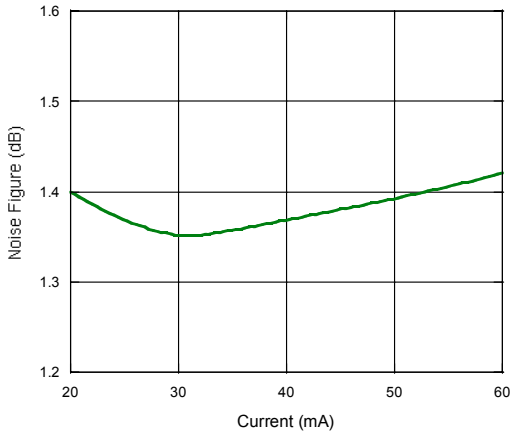
VSWR vs. Frequency



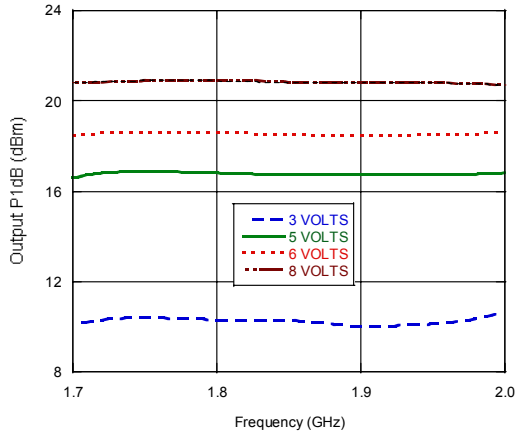
Noise Figure vs. Frequency



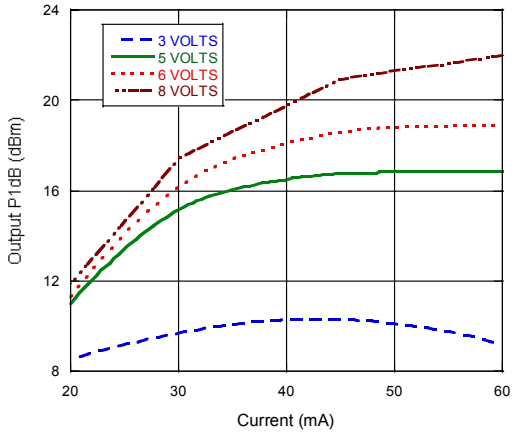
Noise Figure vs. Current, F = 1785 MHz



Output P1 dB vs. Frequency



Output P1 dB vs. Current, F = 1785 MHz



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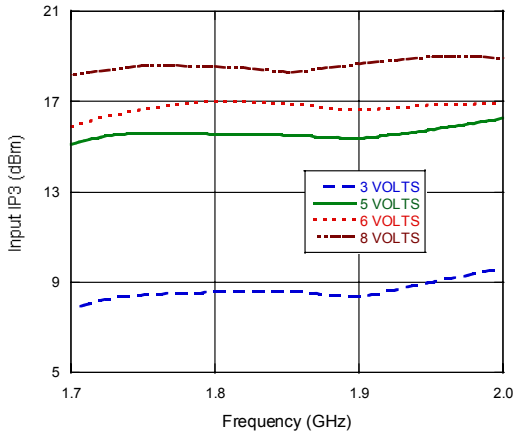
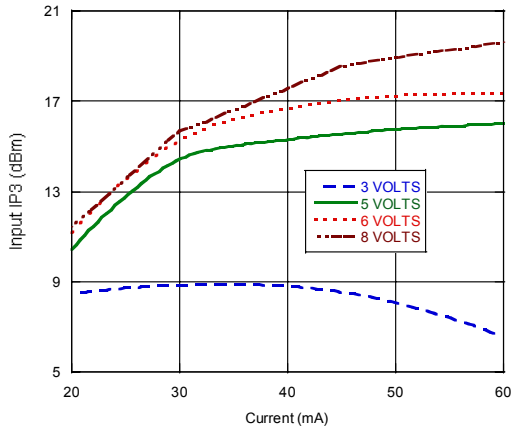
Typical Performance Curves

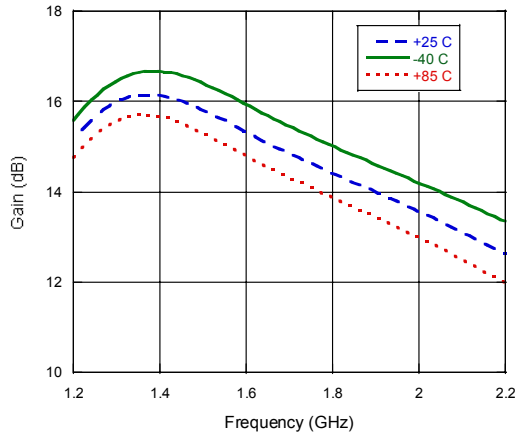
Input IP3 vs. Frequency



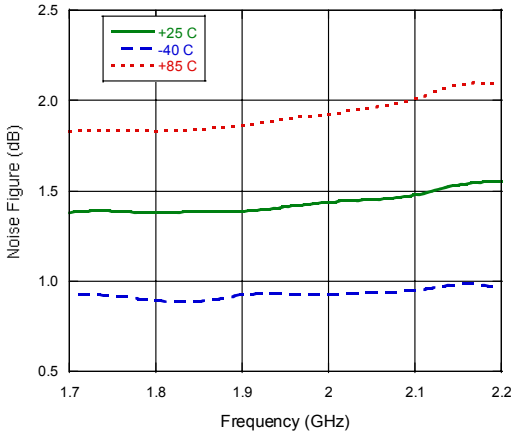
Input IP3 vs. Current, F = 1785 MHz



Gain vs. Temperature



Noise Figure vs. Temperature



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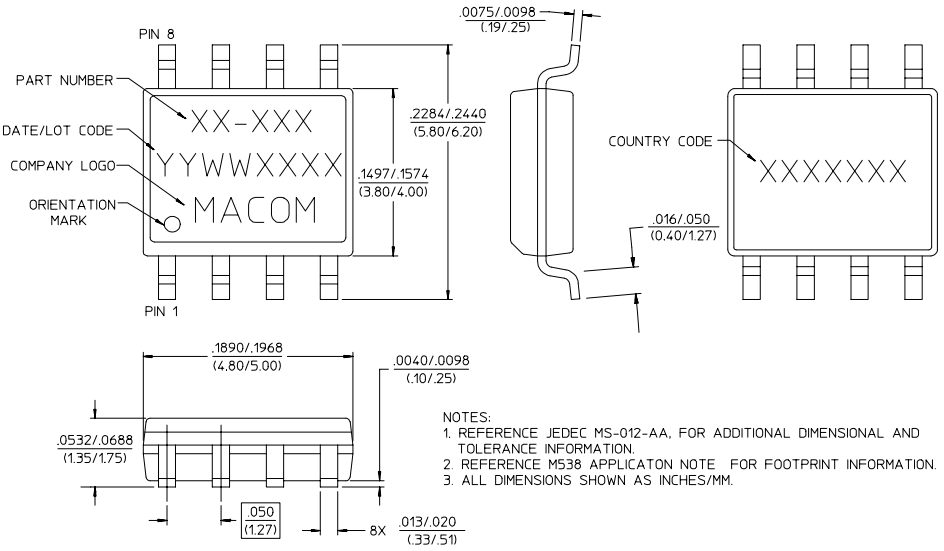
SOIC-8



The AM50-0004 is fabricated using a low-cost 0.5-micron gate length GaAs process. The process features full passivation for increased performance and reliability. The AM50-0004 is 100% RF tested to ensure performance specification compliance.

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