



Mini-Circuits

WIDEBAND, HIGH DYNAMIC RANGE

# Monolithic Amplifier

CMA-82+

50Ω DC to 7 GHz

## THE BIG DEAL

- Ceramic, Hermetic, Nitrogen Filled
- Low Profile Case, 0.045" High
- Ruggedized Design
- Gain, 15 dB Typ. at 100 MHz
- High P1dB, +20 dBm Typ.
- High IP3, +42 dBm Typ. at 100 MHz
- Small Size, 3x3x1.14 mm
- Transient Protected, US Patent 6,943,629



Generic photo used for illustration purposes only

CASE STYLE: DL1721

**+RoHS Compliant**

The +Suffix identifies RoHS Compliance.  
See our website for methodologies and qualifications

MIL SCREENING AVAILABLE  
PLEASE CONSULT APPLICATIONS DEPT.

## APPLICATIONS

- High Rel Systems
- Defense and Aerospace
- Base Station Infrastructure
- LTE
- Point to Point Wireless

## PRODUCT OVERVIEW

Mini-Circuits' CMA-82+ is a wideband monolithic amplifier providing high dynamic range. It uses patented, Transient Protection Darlington Configuration circuit architecture and is fabricated using InGaP HBT technology. The amplifier is bonded to a multilayer integrated LTCC substrate, then hermetically sealed under a controlled Nitrogen atmosphere with gold-plated cover, eutectic Au-Sn solder, and Ni-Pd-Au termination finish. CMA-series amplifiers are capable of meeting MIL requirements for gross leak, fine leak, thermal shock, vibration, acceleration, mechanical shock, and HTOL. The testing can be done if requested.

## KEY FEATURES

Feature	Advantages
Hermetically Sealed	Ideal for use anywhere long-term reliability adds bottom-line value: high moisture areas, busy production lines, high-speed distribution centers, heavy industry, outdoor settings, and unmanned facilities, as well as military applications.
Wideband, DC to 7 GHz	The amplifier covers the primary wireless communications bands including cellular, PCS, LTE, WiMAX, and satellite IF.
High IP3 vs. DC Power Consumption +42 dBm Typical at 0.1 GHz +39 dBm Typical at 1 GHz	The CMA-82+ matches industry leading IP3 performance relative to device size and power consumption. The combination of the design and HBT structure provides enhanced linearity over a broad frequency range. This feature makes the amplifier ideal for use in: <ul style="list-style-type: none"> <li>• Driver amplifiers for complex waveform up converter paths</li> <li>• Drivers in linearized transmit systems</li> </ul>
Saturated Output Power Up to +20 dBm at P1dB	The amplifier delivers high output power with low DC power consumption.
No External Matching Components Required	CMA-82+ provides input return loss 14-35 dB and output return loss up to 8.7-16.7 dB without the need for external matching components, simplifying board layouts and saving space.
Ceramic Hermetic Package	Low inductance, repeatable performance, outstanding reliability in tough operating conditions, and small size (3x3x1.14 mm).

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CMA-82+  
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PAGE 1 OF 5



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ELECTRICAL SPECIFICATIONS<sup>1</sup> AT +25°C AND +5 V, UNLESS NOTED OTHERWISE

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range <sup>2</sup>		DC		7	GHz
Gain	0.1	13.7	15.5	16.8	dB
	1.0		15.1		
	2.0	12.2	14.1	15.2	
	3.0		13.0		
	4.0	9.8	12.0	13.0	
	6.0		10.2		
	7.0		9.2		
Magnitude of Gain Variation vs. Temperature <sup>3</sup> (Values Are Negative)	0.1		0.0002	0.005	dB/°C
	1.0		0.0012		
	2.0		0.0020		
	3.0		0.0027		
	4.0		0.0037		
	6.0		0.0062		
	7.0		0.0108		
Input Return Loss	0.1		35.0		dB
	1.0		19.0		
	2.0		16.0		
	3.0		14.0		
	4.0		14.0		
	6.0		15.5		
	7.0		14.4		
Output Return Loss	0.1		16.7		dB
	1.0		13.2		
	2.0		10.0		
	3.0		8.8		
	4.0		8.7		
	6.0		9.8		
	7.0		10.5		
Reverse Isolation	2.0		23.4		dB
Output Power @ 1 dB Compression	0.1	+18.0	+20.0		dBm
	1.0	+18.0	+20.0		
	2.0	+18.0	+20.6		
	3.0		+20.0		
	4.0		+20.3		
	6.0		+19.0		
	7.0		+18.2		
Output IP3	0.1		+42.0		dBm
	1.0		+39.0		
	2.0		+36.4		
	3.0		+34.5		
	4.0		+33.2		
	6.0		+30.6		
	7.0		+30.1		
Noise Figure	0.1		6.4	8.0	dB
	1.0		6.5		
	2.0		6.7		
	3.0		6.8		
	4.0		6.9		
	6.0		7.3		
	7.0		7.5		
Group Delay	2.0		100		psec
Device Operating Voltage		+4.8	+5.0	+5.2	V
Device Operating Current		90	106	120	mA
DC Current Variation vs. Temperature			70.5		µA/°C
DC Current Variation vs. Voltage			0.038		mA/mV
Thermal Resistance, Junction-to-Ground Lead			93		°C/W

1. Measured on Mini-Circuits test board TB-829-82+. See Characterization Test Circuit (Fig. 1).

2. Low frequency cut off determined by external coupling capacitors and RF Choke (RFC).

3. (Gain at +85°C, Gain at -45°C)/130

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PAGE 2 OF 5



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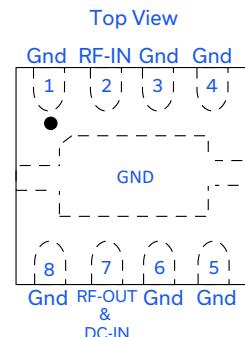
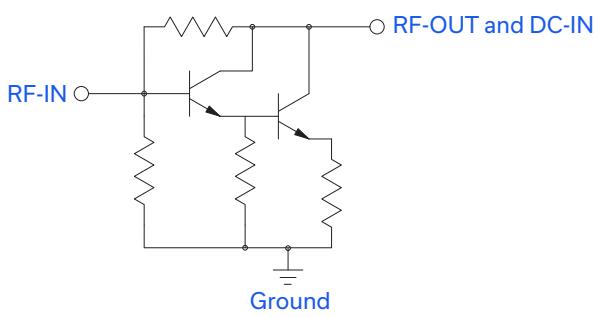
50Ω DC to 7 GHz

## ABSOLUTE MAXIMUM RATINGS

Parameter	Ratings
Operating Temperature (Ground Lead)	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Operating Current at +5 V	160 mA
Power Dissipation	0.84 W
Input Power	+20 dBm
DC Voltage on Pin 3	+5.8 V

Permanent damage may occur if any of these limits are exceeded. These ratings are not intended for continuous normal operation.

## SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION



Function	Pin Number	Description
RF-IN	2	RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation.
RF-OUT and DC-IN	7	RF output and bias pin. DC voltage is present on this pin; therefore a DC blocking capacitor is necessary for proper operation. An RF choke is needed to feed DC bias without loss of RF signal due to the bias connection.
GND	1,3,4,5,6,8, Bottom Center Paddle	Connections to ground. Use via holes as shown in "Suggested Layout for PCB Design" to reduce ground path inductance for best performance.



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## CHARACTERIZATION TEST CIRCUIT

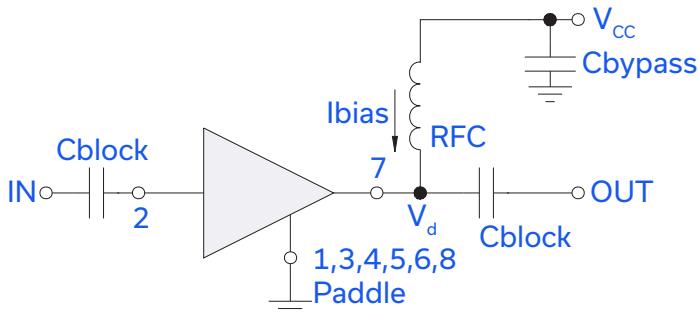
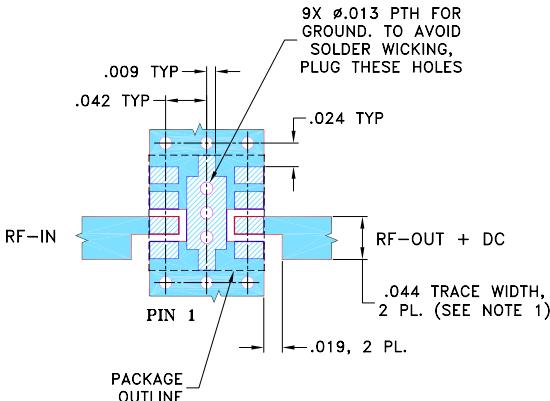


Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Test Board TB-829-82+) Gain, Output Power at 1 dB Compression (P1dB) and Output IP3 (OIP3) are measured using R&S Network Analyzer ZVA-24. Noise Figure measured using Agilent's N5242A PNA-X microwave network analyzer.

### Conditions:

1. Gain and Return Loss:  $P_{IN} = -25$  dBm

## SUGGESTED PCB LAYOUT (PL-366)



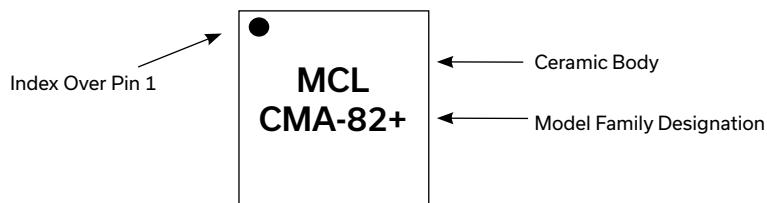
### NOTES:

1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS  $.020" \pm .0015"$ ; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

## PRODUCT MARKING



Markings in addition to model number designation may appear for internal quality control purposes.



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ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASHBOARD. [CLICK HERE](#)

Performance Data & Graphs	Table Graphs S-Parameter (S2P Files) Data Set (.zip file)
Case Style	DL1721 Ceramic package, exposed paddle, Terminal Finish: Ni,Pd,Au
Tape & Reel Standard Quantities Available on Reel	F66-1 7" Reels with 20, 50, 100, 200, 500, 1000 & 2000 devices
Suggested Layout for PCB Design	PL-366
Evaluation Board	TB-656-82+
Environmental Ratings	ENV68

**ESD RATING**

Human Body Model (HBM): Class 1C (1000 V to < 2000 V) in accordance with ANSI/ESD STM 5.1 - 2001  
 Machine Model (MM): Class M2 (100 V to < 200 V) in accordance with ANSI/ESD STM5.2-1999

**MSL RATING**

Moisture Sensitivity: MSL1 (these parts are hermetic, air cavity and therefore, MSL ratings do not strictly apply. For handling purpose, use MSL1)

**QUALIFICATION TESTING**

The table below shows the initial qualification testing performed. If required, parts can be subjected to 100% screening and qualifications testing per MIL standard requirement.

Test Description		Test Method/Process	Results
1	Hermeticity (fine and gross leak)	MIL-STD-202 Method 112, Cond. C & D	Pass
2	Acceleration, 30Kg, Y1 Direction	MIL-STD-883 Method 2001 Cond. E	Pass
3	Vibration , 10-2000Hz sine, 20g, 3 axis	MIL-STD-202 Method 204, Cond. D	Pass
4	Mechanical shock	MIL-STD-202 Method 213, Cond . A	Pass
5	PIND 20G's @130 Hz	MIL-STD-750 Method 2052.2	Pass
6	Temp Cycle -55C/+125C, 1000 Cycles	MIL-STD-202 Method 107	Pass
7	Autoclave, 121C, RH 100%, 15 Psig, 96 hrs	JESD22-A102C	Pass
8	HTOL, 1000hrs, 105C at rated Voltage condition	MIL-STD-202 Method 108, Cond . D	Pass
9	Bend Test	JESD22-B113	Pass
10	Resistance to soldering heat, 3x reflow, 260C peak	JESD22-B102	Pass
11	Drop Test	JESD22-B111	Pass
12	Adhesion Strength	Push Test>10 lb	Pass

**NOTES**

- Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuits' applicable established test performance criteria and measurement instructions.
- The parts covered by this specification document are subject to Mini-Circuits' standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the standard terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at [www.minicircuits.com/terms/viewterm.html](http://www.minicircuits.com/terms/viewterm.html)

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PAGE 5 OF 5