Wideband, High Dynamic Range, Ceramic

Monolithic Amplifier

CMA-84+

50Ω DC to 7 GHz

CASE STYLE: DL1721

The Big Deal

- Ceramic, hermetically sealed, nitrogen filled
- Low profile case, 0.045”
- High IP3, +38 dBm
- High Gain, 24 dB
- High POUT, +21 dBm

Product Overview

Mini-Circuits’ CMA-84+ 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 have been tested to meet MIL requirements for gross leak, fine leak, thermal shock, vibration, acceleration, mechanical shock, and HTOL.

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 • +38.1 dBm at 0.1 GHz • +35 dBm at 1 GHz	The CMA-84+ 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: • Driver amplifiers for complex waveform upconverter paths • Drivers in linearized transmit systems
High gain, 24 dB	Reduces the number of gain stages, lowering component count and overall system cost.
Saturated output power up to +22 dBm at P3dB	The amplifier delivers high output power with low DC power consumption.
No external matching components required	CMA-84+ provides input return loss up to 14-27 dB and output return loss 5.6- 19.5 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 (0.12 x 0.12 x 0.045”)

Wideband, High Dynamic Range, Ceramic

Monolithic Amplifier

DC-7 GHz

Product Features

- Ceramic, hermetically sealed, high reliability
- Low profile case, .045” high
- Ruggedized design
- High Gain, 24 dB typ. at 100 MHz
- High Pout, P1dB 21.0 dBm typ. at 100 MHz
- High IP3, 38 dBm typ. at 100 MHz
- Transient protected, US patent 6,943,629

CASE STYLE: DL1721

CMA-84+

+RoHS Compliant

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

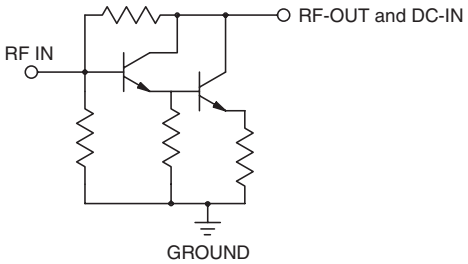
Typical Applications

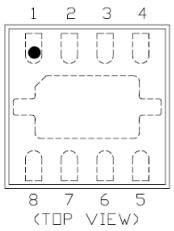
- High Rel Systems
- Defense and Aerospace
- Base station infrastructure
- LTE
- Point to Point Wireless

General Description

CMA-84+ (RoHS compliant) is a wideband amplifier offering high dynamic range. It uses patented Transient Protection Darlington configuration and is fabricated using InGaP HBT technology. The MMIC amplifier is bonded to a multilayer integrated LTCC substrate and then hermetically sealed under a controlled Nitrogen atmosphere with gold plated cover and eutectic Au-Sn solder. Terminal finish is Ni-Pd-Au. It has repeatable lot to lot performance due to tightly controlled semiconductor and assembly processes. These amplifiers have been qualified to MIL requirements and have been tested for hermeticity.

simplified schematic and pin 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, as shown in “Recommended Application Circuit”, Fig. 2
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.

Electrical Specifications[1] at 25°C and 5V, unless noted

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range[2]		DC		7	GHz
Gain	0.1	22.9	24.4	25.3	dB
	1.0	—	22.8	—	
	2.0	18.5	20.2	21.5	
	3.0	—	17.9	—	
	4.0	14.3	16.0	17.5	
	6.0	—	12.6	—	
	7.0	—	10.9	—	
Magnitude of Gain Variation versus Temperature[3] (values are negative)	0.1	—	0.0004	—	dB/°C
	1.0	—	0.0021	—	
	2.0	—	0.0032	0.006	
	3.0	—	0.0044	—	
	4.0	—	0.0058	—	
	6.0	—	0.0131	—	
	7.0	—	0.0175	—	
Input Return Loss	0.1	—	27.0	—	dB
	1.0	—	17.4	—	
	2.0	12.5	14.7	—	
	3.0	—	14.0	—	
	4.0	—	15.0	—	
	6.0	—	17.0	—	
	7.0	—	18.0	—	
Output Return Loss	0.1	—	19.5	—	dB
	1.0	—	8.5	—	
	2.0	—	5.8	—	
	3.0	—	5.6	—	
	4.0	—	5.9	—	
	6.0	—	6.7	—	
	7.0	—	6.8	—	
Reverse Isolation	2.0		27.7		dB
Output Power @1 dB compression	0.1	19.4	21.0	—	dBm
	1.0	19.5	20.8	—	
	2.0	19.6	21.0	—	
	3.0	—	20.6	—	
	4.0	—	19.9	—	
	6.0	—	17.2	—	
	7.0	—	15.6	—	
Saturated Output Power (at 3dB compression)	0.1		21.4		dBm
	1.0		21.7		
	2.0		22.3		
	3.0		21.3		
	4.0		20.8		
	6.0		18.9		
	7.0		17.4		
Output IP3	0.1	34.0	38.1	—	dBm
	1.0	32.2	35.0	—	
	2.0	32.5	34.5	—	
	3.0	—	32.3	—	
	4.0	—	31.5	—	
	6.0	—	28.8	—	
	7.0	—	28.7	—	
Noise Figure	0.1	—	5.1	6.5	dB
	1.0	—	5.2	—	
	2.0	—	5.5	6.5	
	3.0	—	5.5	—	
	4.0	—	5.6	6.6	
	6.0	—	6.0	—	
	7.0	—	6.3	—	
Group Delay	2.0		94		psec
Device Operating Voltage		4.8	5.0	5.2	V
Device Operating Current		85	108	130	mA
Device Current Variation vs. Temperature			61.8		µA/°C
Device Current Variation vs Voltage			0.058		mA/mV
Thermal Resistance, junction-to-ground lead			86		°C/W

[1] Measured on Mini-Circuits test board TB-829-84+. See Characterization Test Circuit (Fig. 1)
[2] Low frequency cut off determined by external coupling capacitors and external bias choke.
[3] (Gain at 85°C - Gain at -45°C)/130

Absolute Maximum Ratings

Parameter	Ratings
Operating Temperature (ground lead)	-45°C to 85°C
Storage Temperature	-65°C to 150°C
Operating Current at 5V	160mA
Power Dissipation	1W
Input Power	13 dBm
DC Voltage on Pin 3	5.8V

Note:
Permanent damage may occur if any of these limits are exceeded.
Electrical maximum ratings are not intended for continuous normal operation.

Characterization Test Circuit

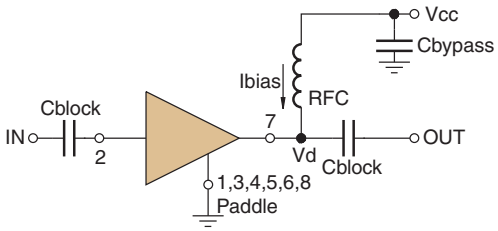
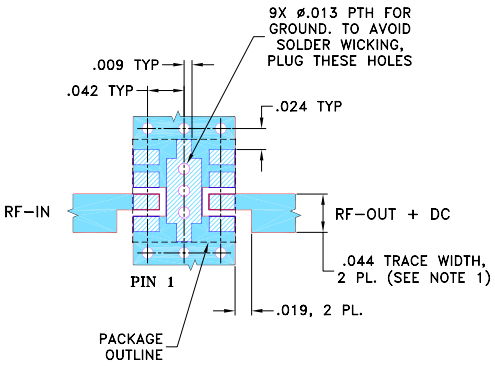


Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Test Board TB-829-84+)

Gain, Output power at 1dB compression (P1 dB) 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: Pin= -25dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 0 dBm/tone at output.

Suggested PCB Layout (PL-366)

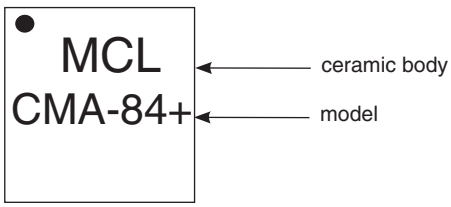


NOTES:
1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .020" ± .0015"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

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

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Product Marking



Additional Detailed Technical Information *additional information is available on our dash board. To access this information click here*	
Performance Data	Data Table
	Swept 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 or 1K, 2K devices.*
Suggested Layout for PCB Design	PL-366
Evaluation Board	TB-656-84+
Environmental Ratings	ENV-68

ESD Rating

Human Body Model (HBM): Class 1C (1000 to <2000V) in accordance with ANSI/ESD STM 5.1 - 2001

Machine Model (MM): Class M2 (100 to <200V) 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

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

Additional Notes

A. 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.

B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.

C. 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/MCLStore/terms.jsp