Low Noise, High IP3

Monolithic Amplifier

CMA-5043+

50Ω 0.05 to 4 GHz

CASE STYLE: DL1721

The Big Deal

- Ceramic, Hermetically Sealed, Nitrogen filled
- Low profile case, .045” high
- Ultra Low Noise Figure, 0.75 dB
- High IP3 and Po at low DC power consumption
- Class 1B HBM ESD rating (500V)

Product Overview

Mini-Circuits CMA-5043+ is a E-PHEMT based Ultra-Low Noise MMIC Amplifier operating from 50 MHz to 4 GHz with a unique combination of low noise and high IP3 making this amplifier ideal for sensitive high dynamic range receiver applications. This design operates on +3 to +5V supply at only 33 mA at 3V and 56mA at +5V, is internally matched to 50 ohms. The MMIC amplifier is bonded to a multilayer integrated LTCC substrate and then hermetically sealed under a controlled nitrogen atmosphere with gold-plated covers and eutectic AuSn solder. These amplifiers have been tested to MIL requirements for gross leak, fine leak, thermal shock, vibration, acceleration, mechanical shock, and HTOL.

Key Features

Feature	Advantages
Ultra Low Noise: 0.75 dB at 1 GHz 0.98 dB at 2 GHz	Outstanding Noise Figure, ideal for low noise input stages of receivers
High IP3, 33.5 dBm	Combining Low Noise and High IP3 makes this MMIC amplifier ideal for Low Noise Receiver Front End (RFE) because it gives the user advantages at both ends of the dynamic range: sensitivity & two-tone spur-free dynamic range
High Output Power, +21 dBm	The CMA-5043+ provides up to +21dBm output power at 1dB compression enabling this amplifier to support high linear dynamic range requirements
Broad Band, up to 4 GHz	Operating over a broadband from 50 MHz to 4 GHz, the CMA-5043+ covers the primary wireless communications bands: Cellular, PCS, LTE, WiMAX
Internally Matched	No external matching elements required to achieve the advertised noise and output power over the full band
Ceramic Hermetic Package	Low inductance, repeatable performance, excellent reliability
High Reliability	Low, small signal operating current of 53mA nominal maintains junction temperatures typically below 125°C at 85°C ground lead temperature
Class 1B ESD (500V, HBM)	The CMA-5043+ is a super low noise PHEMT based design. Unlike many other PHEMT designs. Mini-Circuits incorporates ESD protection on die to achieve industry leading ESD performance for a low noise amplifier

Low Noise, High IP3

Monolithic Amplifier 0.05-4 GHz

Product Features

- Ultra Low Noise Figure, 0.75 dB typ. at 1 GHz
- Gain, 18.4 dB typ. at 1GHz
- High Pout, P1dB up to 21 dBm typ.
- High IP3, up to 33.5 dBm typ. at 1 GHz
- Class 1B HBM ESD rating (500V)
- Small size - 3mm x 3mm x 1.14mm
- Ceramic, hermetic, Nitrogen filled
- No external matching components required

CMA-5043+

CASE STYLE: DL1721

+RoHS Compliant

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

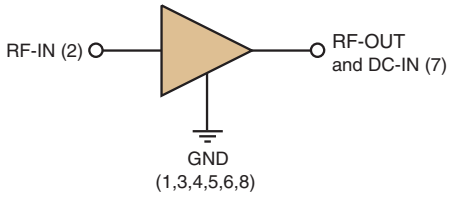
Typical Applications

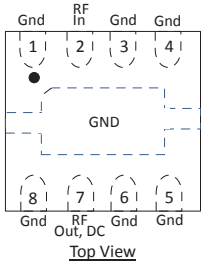
- Base station infrastructure
- Portable Wireless
- CATV & DBS
- MMDS & Wireless LAN
- LTE

General Description

CMA-5043+ is an advanced wide band, high dynamic range, low noise, high IP3, high output power, monolithic amplifier. Manufactured using E-PHEMT* technology enables it to work with a single positive supply voltage. Terminal finish is Ni-Pd-Au and it has repeatable performance from lot to lot due to fully automated, tightly controlled semiconductor and assembly processes.

simplified schematic and pad description





Function	Pad Number	Description *(See Application Circuit, Fig. 2)*
RF IN	2	RF input pin (connect to RF-IN via DC blocking cap)
RF-OUT & 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.

* Enhancement mode pseudomorphic High Electron Mobility Transistor.

Electrical Specifications[1] at 25°C, Zo=50Ω, *(refer to characterization circuit, Fig. 1)*

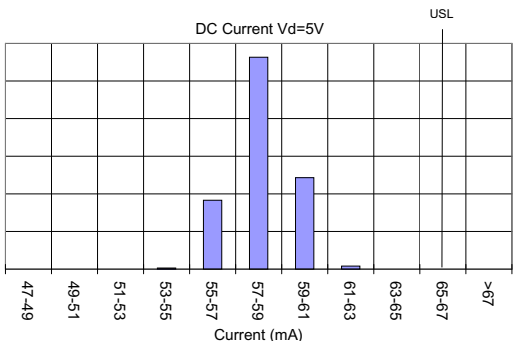
Parameter	Condition (GHz)	Vd=5.0V[1]			Vd=3.0V[1]			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Frequency Range		0.05		4.0	0.05		4.0	GHz
Noise Figure	0.05	—	0.73	—		0.66		dB
	0.5	—	0.65	—		0.66		
	1.0	—	0.75	1.10		0.73		
	2.0	—	0.98	—		0.94		
	3.0	—	1.10	—		1.10		
	4.0	—	1.44	—		1.30		
Gain	0.05	—	25.4	—		24.3		dB
	0.5	—	22.1	—		21.2		
	1.0	16.5	18.4	20.2		17.5		
	2.0	—	13.3	—		12.5		
	3.0	—	10.2	—		9.6		
	4.0	—	8.0	—		7.2		
Input Return Loss	0.05		7.8			6.5		dB
	0.5		10.5			9.4		
	1.0		11.4			10.6		
	2.0		12.2			11.1		
	3.0		12.8			10.4		
	4.0		11.1			9.2		
Output Return Loss	0.05		13.7			13.2		dB
	0.5		15.0			15.9		
	1.0		13.9			15.1		
	2.0		12.5			14.5		
	3.0		11.7			13.3		
	4.0		12.8			15.7		
Output Power @1dB compression [2]	0.05		18.9			15.8		dBm
	0.5		19.3			16.5		
	1.0		19.8			17.4		
	2.0		20.7			19.0		
	3.0		21.2			19.4		
	4.0		21.5			19.8		
Output IP3	0.05		31.0			28.0		dBm
	0.5		32.1			28.0		
	1.0		33.5			28.7		
	2.0		32.7			30.0		
	3.0		33.6			31.0		
	4.0		32.6			31.0		
DC Volts (Vd)			5.0			3.0		V
DC Current (Id)			58	66		33		mA
DC Current Variation Vs. Temp.[3]			-0.007			-0.007		mA/°C
DC Current Variation Vs. Voltage			0.01			0.01		mA/mV
Thermal Resistance[4]			117			117		°C/W

[1] Measured on Mini-Circuits Characterization test board TB-757+. See Characterization Test Circuit (Fig. 1)
[2] Current increases at P1dB
[3] (Current at 85°C - Current at -45°C)/130

Absolute Maximum Ratings[4]

Parameter	Ratings
Operating Temperature[5]	-55°C to 105°C
Storage Temperature	-65°C to 125°C
Channel Temperature	150°C
DC Voltage	6V
Device Current	76 mA
Power Dissipation	380 mW
Input Power (CW)	23 dBm (5 minutes max), 17dBm (continous)

[4] Permanent damage may occur if any of these limits are exceeded.
These maximum ratings are not intended for continuous normal operation.
[5] Defined with reference to ground pad temperature.



Characterization Test Circuit

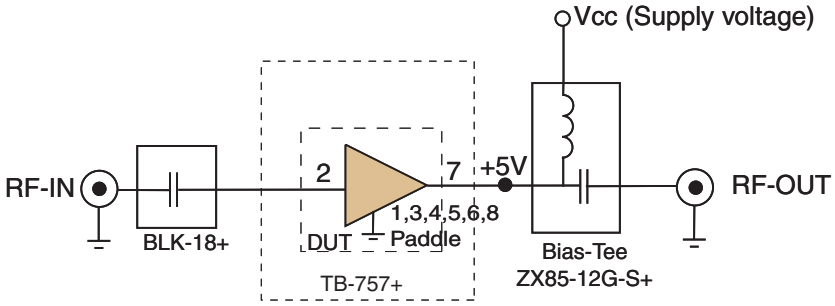


Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-656-62+) Gain, Return loss, Output power at 1dB compression (P1 dB) , output IP3 (OIP3) and noise figure measured using Agilent's N5242A PNA-X microwave network analyzer.

Conditions:
1. Gain and Return loss: Pin= -25dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 0 dBm/tone at output.

Recommended Application Circuit

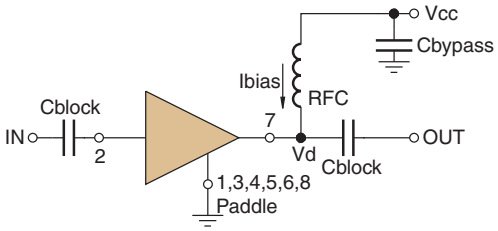
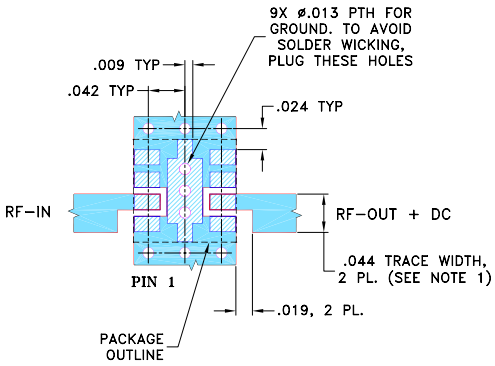


Fig 2. Test Board includes case, connectors, and components soldered to PCB for component values, please see evaluation board drawing.

Suggested PCB Layout (PL-366)

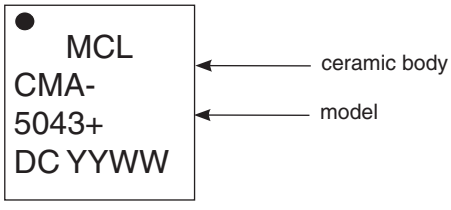


NOTES:
1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .020" ± .0015"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

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, Terminla finish: NiPdAu*
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-757+
Environmental Ratings	ENV-68

ESD Rating

Human Body Model (HBM): Class 1B (500 to <1000V) in accordance with ANSI/ESD STM 5.1 - 2001

Machine Model (MM): Class M1 (pass 35V) 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
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

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