LOW NOISE, HIGH IP3

Monolithic Amplifier CMA-5043+

50Ω 0.05 to 4 GHz

THE BIG DEAL

- Ceramic, Hermetic, Nitrogen Filled
- Ultra Low Noise Figure, 0.75 dB Typ. at 1 GHz
- Gain, 18.4 dB Typ. at 1 GHz
- High P_{OUT}, P1dB Up to +21 dBm Typ.
- High IP3, Up to +33.5 dBm Typ. at 1 GHz
- Class 1B HBM ESD Rating (+500 V)
- Small Size, 3x3x1.14 mm
- No External Matching Components Required

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

- Base Station Infrastructure
- Portable Wireless
- CATV & DBS
- MMDS & Wireless LAN
- LTE

PRODUCT OVERVIEW

Mini-Circuits CMA-5043+ is a E-pHEMT based Ultra-Low Noise MMIC Amplifier operating from 0.05 GHz 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 V to +5 V supply at only 33 mA at +3 V and 56 mA at +5 V, is internally matched to 50Ω. 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 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
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 +21 dBm output power at 1 dB compression, enabling this amplifier to support high linear dynamic range requirements.
Broadband, 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 53 mA nominal maintains junction temperatures typically below +125°C at +85°C ground lead temperature
Class 1B ESD (+500 V, 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.

REV. D
ECO-025417
CMA-5043+
MCL NY
250502

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ELECTRICAL SPECIFICATIONS[1] AT +25°C, Zo=50Ω, UNLESS OTHERWISE NOTED

Parameter	Condition (GHz)	V_d=+5.0 V[1]			V_d=+3.0 V[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 @ 1 dB 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 (V_d)			+5.0			+3.0		V
DC Current (I_d)			58	66		33		mA
DC Current Variation vs. Temperature[3]			-0.007			-0.007		mA/°C
DC Current Variation vs. Voltage			0.01			0.01		mA/mV
Thermal Resistance			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

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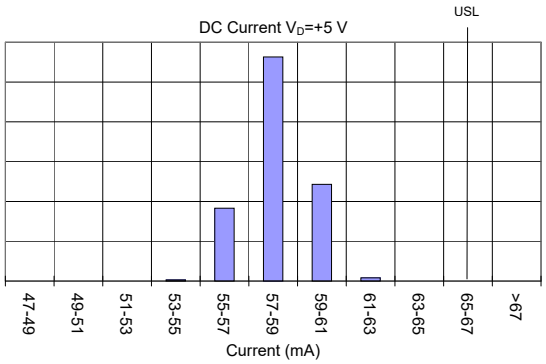
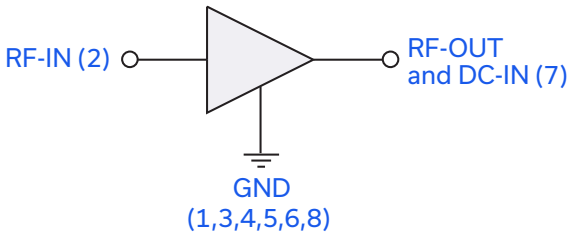
ABSOLUTE MAXIMUM RATINGS[4]

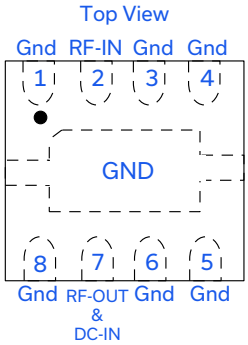
Parameter	Ratings
Operating Temperature[5]	-55°C to +105°C
Storage Temperature	-65°C to +125°C
Channel Temperature	+150°C
DC Voltage	+6 V
Device Current	76 mA
Power Dissipation	380 mW
Input Power (CW)	+23 dBm (5 mins max.) +17 dBm (continuous)

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



SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION





Function	Pin 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.

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CHARACTERIZATION TEST CIRCUIT

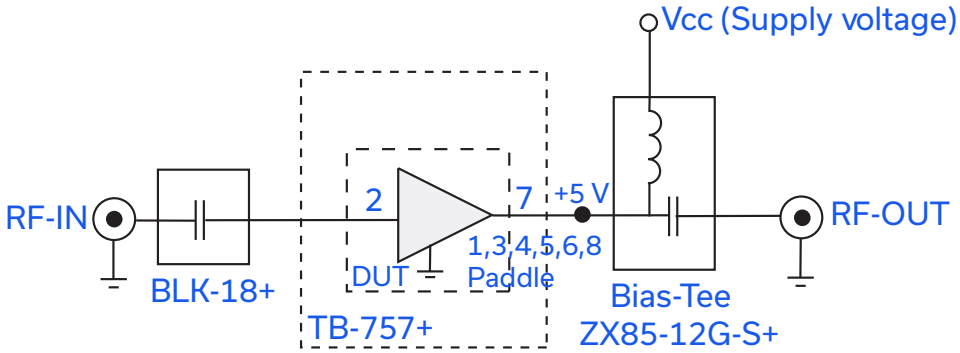


Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-656-62+) Gain, Return Loss, Output Power at 1 dB Compression (P1dB), Output IP3 (OIP3) and Noise Figure measured using Agilent's N5242A PNA-X microwave network analyzer.

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

RECOMMENDED APPLICATION CIRCUIT

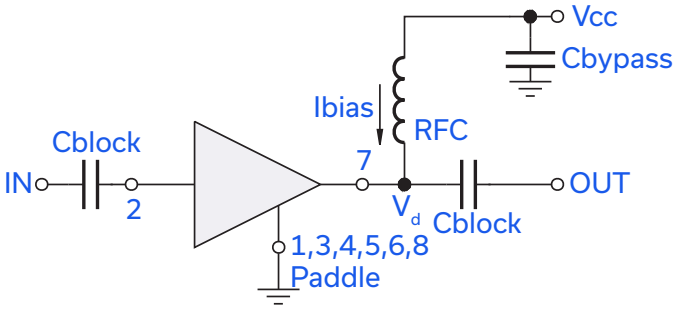
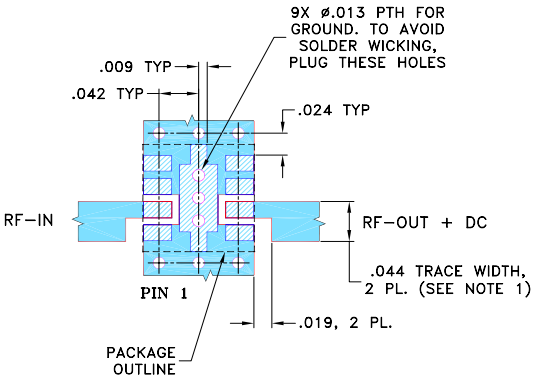


Fig 2. Test Board includes case, connectors, and components soldered to PCB for component values, please see evaluation board drawing.

SUGGESTED PCB LAYOUT (PL-366)

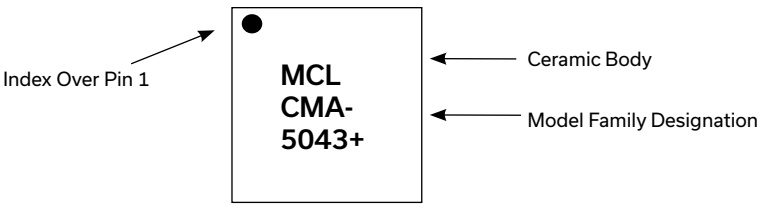


NOTES:
1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .020" ± .0015"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

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

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

PRODUCT MARKING



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-757+
Environmental Ratings	ENV68

ESD RATING

Human Body Model (HBM): Class 1B (500 V to < 1000 V) in accordance with ANSI/ESD STM 5.1 - 2001
Machine Model (MM): Class M1 (pass 35 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

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-Circuits' 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/terms/viewterm.html