

# Ultra Low Noise, Low Current, Shutdown Monolithic Amplifier

## PMA2-133LN+

50Ω 10 to 13 GHz

### The Big Deal

- Ultra-low noise figure, 1.3 dB
- Low Current, 13 mA at 3V and 29mA at 5V
- Excellent ESD protection, Class 1C
- Small size, 2 x 2 x 1mm
- Shutdown feature



2mm x 2mm

### Product Overview

Mini-Circuits' PMA2-133LN+ is an E-PHEMT based, ultra-low noise MMIC amplifier. The model offers a unique combination of low current consumption, low noise and high IP3, making it an ideal for sensitive, high-dynamic-range receiver applications. This design operates at both 3V & 5V supply, is well matched for 50Ω systems, and comes in a tiny, low-profile package, accommodating dense circuit board layouts.

### Key Features

Feature	Advantages
Ultra-low noise, 1.3 dB at 11 GHz	Enables lower system noise figure performance.
High IP3, 28.6 dBm typ. at 11 GHz	The combination of low noise and high IP3 makes the PMA2-133LN+ ideal for use in low noise receiver front end (RFE) as it gives the user the advantages of sensitivity and two-tone IM performance at both ends of the dynamic range.
Support Low operating voltage, 3V&5V	Usable in battery operated systems.
Low current consumption, 13 mA at 3V 29 mA at 5V	Enables prolonged battery life.
Shutdown feature (Ven=0V, V <sub>DD</sub> =3/5V)	Saves DC power consumption when it is not required.
Separate pads for V <sub>DD</sub> and RF-OUT	Built-in RF-choke separates V <sub>DD</sub> and RF-OUT ports, minimizing external components, cost and saving PCB space.
Excellent ESD protection, Class 1C	Robust ESD performance eliminates the need for external ESD protection circuits, saving PCB space, minimizing noise figure degradation, and reducing cost.
2 x 2mm, 6-lead MCLP package	Tiny footprint saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB.



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## PMA2-133LN+

CASE STYLE: MC1630-1

### +RoHS Compliant

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

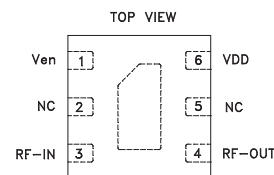
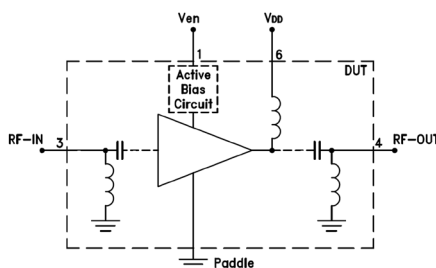
### Typical Applications

- Satellite communication
- Military Radar
- VSAT
- Point to Point
- Radio Astronomy

### General Description

The PMA2-133LN+ (RoHS compliant) amplifier is fabricated using InGaAs E-PHEMT technology and offers extremely high dynamic range with ultra low noise figure and good input and output return loss. It has repeatable performance from lot to lot and is enclosed in a 2mm x 2mm x 1mm package for very good thermal performance. It has separate terminal to VDD & RF-OUT simplifying design of external circuit.

### simplified schematic & pad description



Function	Pad Number	Description
RF-IN	3	RF Input pad. This pad requires the use of an external DC blocking capacitor.
RF-OUT	4	RF Output pad. This pad requires the use of an external DC blocking capacitor.
V <sub>DD</sub>	6	DC Supply pad, Connect to external DC power supply.
V <sub>en</sub>	1	Gain or shutdown model enable voltage pad. Connect to VDD for Gain mode operation. Connect to Ground to shutdown the amplifier.
GND	Paddle	Connections to Ground.
NC	2,5	Pads have no connections internally. Connect pads to Ground externally.

Electrical Specifications<sup>1</sup> at 25°C, 3V&5V, and 50 ohms unless noted

Parameter	Condition (GHz)	3V			5V	Units
		Min.	Typ.	Max.	Typ.	
Frequency Range		10		13		GHz
Noise Figure	10.0		1.4		1.5	dB
	10.7		1.4		1.3	
	11.0		1.4		1.3	
	12.0		1.5		1.4	
	13.0		1.6		1.5	
Gain	10.0	—	14.1	—	15.3	dB
	10.7	—	14.1	—	15.3	
	11.0	—	14.1	—	15.3	
	12.0	11.1	14.1	15.3	15.6	
	13.0	—	14.0	—	15.8	
Reverse Isolation	11.0		22.7		23.3	dB
Input Return Loss	10.0		13		16	dB
	10.7		14		17	
	11.0		14		17	
	12.0		17		21	
	13.0		27		24	
Output Return Loss	10.0		18		14	dB
	10.7		16		12	
	11.0		16		12	
	12.0		26		18	
	13.0		13		18	
Output Power at 1dB Compression	10.0		8.4		13.3	dBm
	10.7		9.4		14.4	
	11.0		8.9		13.5	
	12.0		8.5		13.1	
	13.0		7.1		11.5	
Output IP3 Pout=-10 dBm/tone	10.0		23.4		27.9	dBm
	10.7		23.7		29.3	
	11.0		23.6		28.6	
	12.0		23.8		28.8	
	13.0		23.5		28.9	
Device Operating Voltage (V <sub>DD</sub> ) <sup>3</sup>			3.0		5.0	V
Device Operating Current (I <sub>DD</sub> )			13	21	29	mA
Device Current Variation vs. Temperature <sup>2</sup>			-10		-53	μA/°C
Device Current Variation vs. Voltage			0.0079		0.0076	mA/mV
Thermal Resistance, junction-to-ground lead			124		118	°C/W

<sup>1</sup> Measured on Mini-Circuits Characterization test board TB-991+. See Characterization Test Circuit (Fig. 1)

<sup>2</sup> (Current at 85°C - Current at -45°C)/130

<sup>3</sup> V<sub>DD</sub> is connected to Ven.

Absolute Maximum Ratings<sup>4</sup>

Parameter	Ratings
Operating Temperature (ground lead)	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Total Power Dissipation	0.31W
Input Power (CW)	+19 dBm (5minutes max) +10 dBm (continuous)
DC Voltage	+7.7V

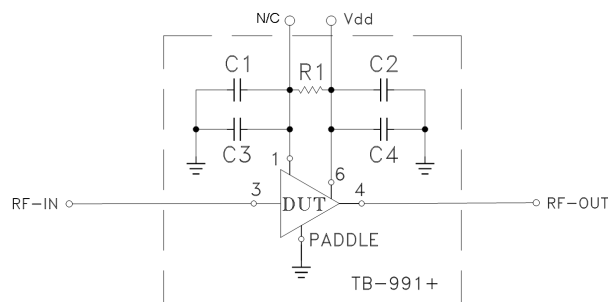
Note:

<sup>4</sup> Permanent damage may occur if any of these limits are exceeded.

Electrical maximum ratings are not intended for continuous normal operation.



Recommended Application and Characterization Test Circuit



For Gain Mode Operation:

Component	Size	Value	Manufacturer	P/N
C1, C2	0402	0.1uF	Murata	GRM155R71C104KA88D
C3, C4	0402	100pF	Murata	GRM1555C1H101J01D
R1	0402	0 ohms	KOA	RK73Z1JTDD

Fig 1. Application and Characterization Circuit

This block diagram is used for DUT characterization in Gain Mode operation. (DUT soldered on Mini-Circuits Characterization test board TB-991+).

Gain, Return loss, Output power at 1dB compression (P1dB), 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, -10 dBm/tone at output.

Product Marking



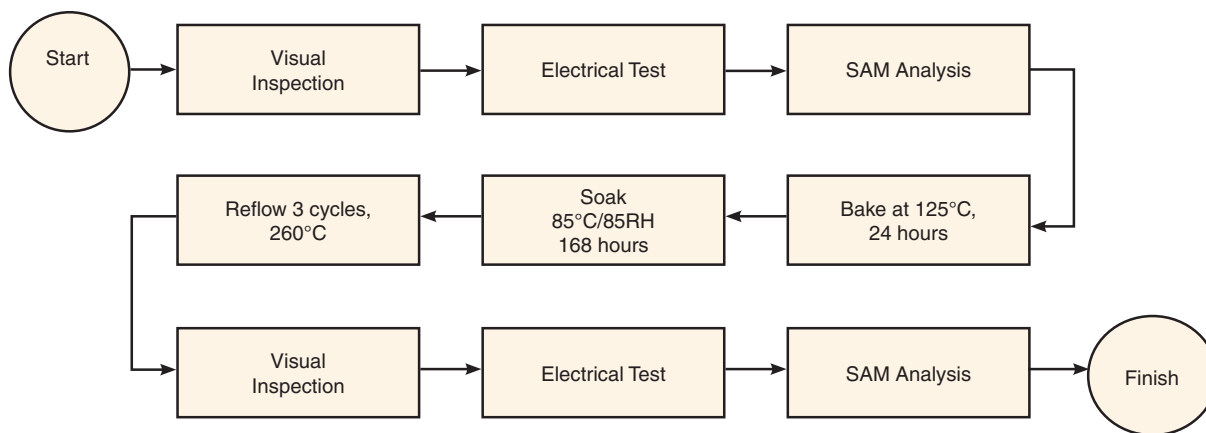
Marking may contain other features or characters for internal lot control

Additional Detailed Technical Information	
<i>additional information is available on our dash board. To access this information <a href="#">click here</a></i>	
<b>Performance Data</b>	Data Table
	Swept Graphs
	S-Parameter (S2P Files) Data Set (.zip file)
<b>Case Style</b>	MC1630-1 <i>Plastic package, exposed paddle, lead finish: matte-tin</i>
<b>Tape &amp; Reel</b> Standard quantities available on reel	F66 <i>7" reels with 20, 50, 100, 200, 500 or 1K devices</i>
<b>Suggested Layout for PCB Design</b>	PL-585
<b>Evaluation Board</b>	TB-991+
<b>Environmental Ratings</b>	ENV08T1

### ESD Rating

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

### MSL Test Flow Chart



#### 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](http://www.minicircuits.com/MCLStore/terms.jsp)