



ULTRA LOW NOISE, LOW CURRENT, SHUTDOWN

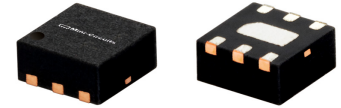
Monolithic Amplifier

PMA2-133LN+

50Ω 10 to 13 GHz

THE BIG DEAL

- Low noise figure, 1.3 dB at 11 GHz
- Low current, 13 mA at 3V, 29 mA typ. at 5V
- Excellent ESD protection Class 1C
- Small size, 2 x 2 x 1 mm
- Shutdown feature



Generic photo used for illustration purposes only

CASE STYLE: MC1630-1

+RoHS Compliant

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

APPLICATIONS

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

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 _{DD} =3/5V) | Saves DC power consumption when it is not required. |
| Separate pads for V _{DD} and RF-OUT | Built-in RF-choke separates VDD 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. |

*Enhancement mode Pseudomorphic High Electron Mobility Transistor

REV. A
ECO-011027
PMA2-133LN+
RS/CP
211209





ULTRA LOW NOISE, LOW CURRENT, SHUTDOWN

Monolithic Amplifier

PMA2-133LN+

Mini-Circuits

ELECTRICAL SPECIFICATIONS¹ AT 25°C, 3V&5V, AND 50 OHMS UNLESS NOTED OTHERWISE

| 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_{DD}) ³ | | | 3.0 | | 5.0 | V |
| Device Operating Current (I_{DD}) | | | 13 | 21 | 29 | mA |
| Device Current Variation vs. Temperature ² | | | -10 | | -53 | $\mu A/^{\circ}C$ |
| Device Current Variation vs. Voltage | | | 0.0079 | | 0.0076 | mA/mV |
| Thermal Resistance, junction-to-ground lead | | | 124 | | 118 | $^{\circ}C/W$ |

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

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

3 VDD is connected to Ven.

MAXIMUM RATINGS⁴

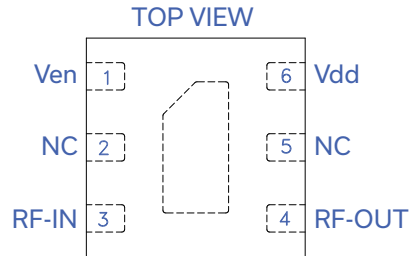
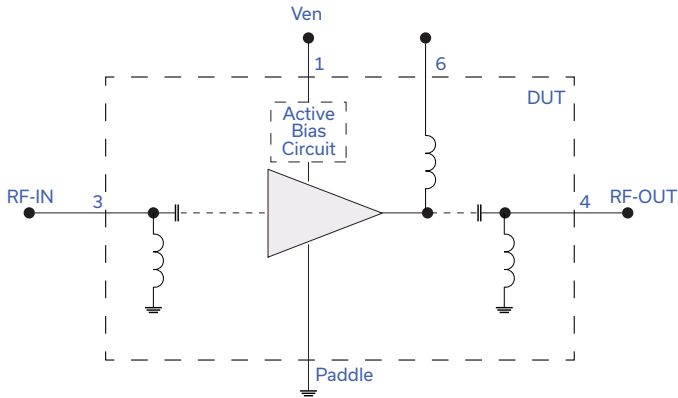
| Parameter | Ratings |
|-------------------------------------|--|
| Operating Temperature (ground lead) | -40°C to 85°C |
| Storage Temperature | -65°C to 150°C |
| Total Power Dissipation | 0.31W |
| Input Power (CW) | +19 dBm (5minutes max) +10 dBm (continuous) |
| DC Voltage | +7.7V |

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





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 _{DD} | 6 | DC Supply pad, Connect to external DC power supply. |
| V _{en} | 1 | Gain or shutdown model enable voltage pad. Connect to VDD for Gain mode operation. Connect to Ground to shut-down the amplifier. |
| GND | Paddle | Connections to Ground. |
| NC | 2,5 | Pads have no connections internally. Connect pads to Ground externally. |



RECOMMENDED APPLICATION AND CHARACTERIZATION TEST CIRCUIT

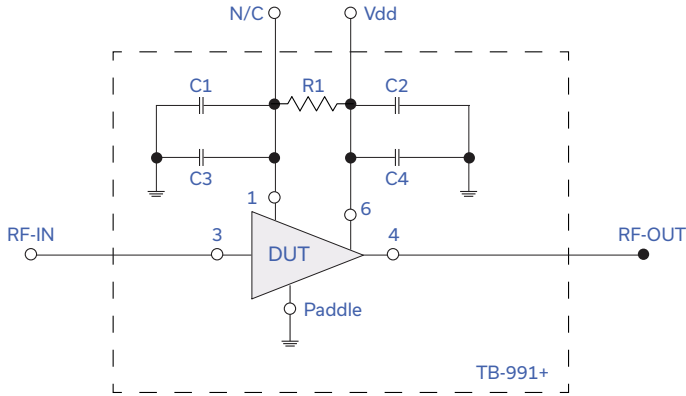


Fig 1. Application and Characterization Circuit

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.

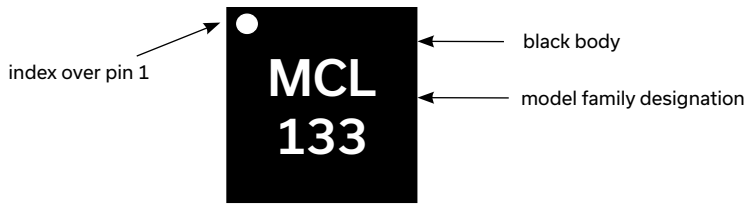
Conditions:

1. Gain and Return loss: Pin= -25dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, -10 dBm/tone at output.

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 | RK73Z1JTTD |

PRODUCT MARKING



Marking may contain other features or characters for internal lot control



ULTRA LOW NOISE, LOW CURRENT, SHUTDOWN

Wideband Amplifier

PMA2-133LN+

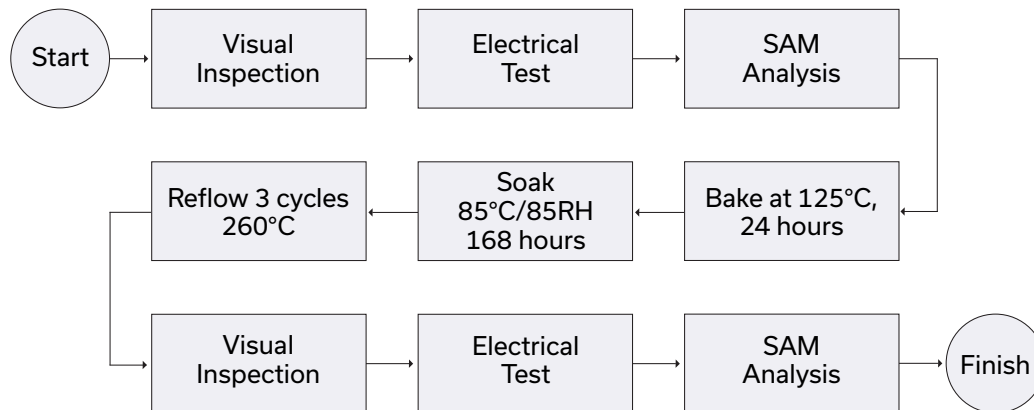
ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD. TO ACCESS [CLICK HERE](#)

| | |
|---------------------------------------|--|
| Performance Data | Data Table Swept Graphs S-Parameter (S2P Files) Data Set (.zip file) |
| Case Style | MC1630-1 Plastic package, exposed paddle, lead finish: matte-tin |
| Tape & Reel | F66 |
| Standard quantities available on reel | 7" reels with 20, 50, 100, 200, 500 or 1K devices |
| Suggested Layout for PCB Design | PL-585 |
| Evaluation Board | TB-991+ |
| Environmental Ratings | ENV08T1 |

ESD RATING

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

MSL TEST FLOW CHART



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

