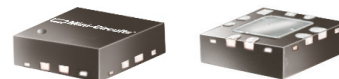


Low Noise, High IP3

Monolithic Amplifier

PMA-5451+

50Ω 0.05 to 6 GHz



3mm x 3mm MCLP (EIA: QFN) Pkg

The Big Deal

- Ultra Low Noise Figure, 0.6 dB
- High IP3/Low Current, 30mA
- Wideband, up to 6 GHz

Product Overview

Mini-Circuits PMA-5451+ is a E-PHEMT based Ultra-Low Noise MMIC Amplifier operating from 50 MHz to 6 GHz with a unique combination of low noise and high IP3 making this amplifier ideal for sensitive receiver applications. This design operates on a single 3V supply at only 30mA and is internally matched to 50 Ohms.

Key Features

| Feature | Advantages |
|-------------------------|--|
| Ultra Low Noise, 0.6 dB | Outstanding Noise Figure, measured in a 50 Ohm environment without any external matching |
| High IP3, 29 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 |
| Low Current, 30mA | At only 30mA, the PMA-5451+ is ideal for remote applications with limited available power or densely packed applications where thermal management is critical. |
| Broad Band | Operating over a broadband the PMA-5451+ 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 |
| MCLP Package | Low Inductance, repeatable transitions, excellent thermal pad |
| Max Input Power, +20dBm | Ruggedized design operates up to input powers of +20dBm without the need of an external limiter |
| High Reliability | Low, small signal operating current of 30 mA nominal maintains junction temperatures typically below 100°C at 85°C ground lead temperature |

Notes

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Low Noise, High IP3

Monolithic Amplifier

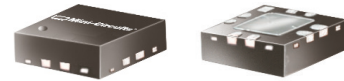
0.05-6 GHz

Product Features

- Single Positive Supply Voltage, 3V, Id=30mA
- Ultra Low Noise Figure, 0.6 dB typ. at 0.5GHz
- High IP3, 29 dBm typ. 1GHz
- Gain, 19dB typ. at 1 GHz
- Output Power, up to +17dBm typ.
- Micro-miniature size - 3mm x 3mm
- Aqueous washable

Typical Applications

- Cellular
- ISM
- GSM
- WCDMA
- LTE
- WiMAX
- WLAN
- UNII and HIPERLAN



PMA-5451+

CASE STYLE: DQ849

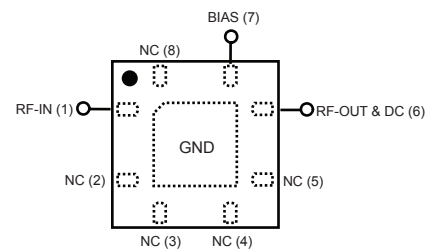
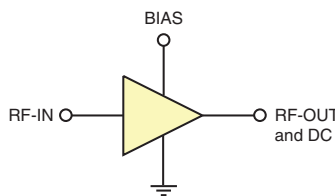
+RoHS Compliant

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

General Description

PMA-5451+ is a 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.

simplified schematic and pad description



| Function | Pad Number | Description (See Application Circuit, Fig. 3) |
|-------------|----------------------------|---|
| RF-IN | 1 | RF input pad |
| RF-OUT & DC | 6 | RF output pad (connected to RF-OUT via blocking external cap C2, and Supply voltage Vs via RF Choke L1) |
| BIAS | 7 | Bias pad (connected to Vs via Rbias) |
| GND | paddle in center of bottom | Connected to ground |
| NOT USED | 2,3,4,5,8 | No internal connection; recommended use: per PCB Layout PL-299 |

*Enhancement mode Pseudomorphic High Electron Mobility Transistor.

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PMA-5451+
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150924
Page 2 of 6

Electrical Specifications⁽¹⁾ at 25°C, Z_o=50Ω, (refer to characterization circuit, Fig. 1)

| Parameter | Condition (GHz) | Min. | Typ. | Max. | Units |
|---|-----------------|------|--------|------|-------|
| Frequency Range | | 0.05 | | 6.0 | GHz |
| DC Voltage (V _d) | | | 3.0 | | V |
| DC Current (I _d) ⁽⁶⁾ | | 20 | 30 | 40 | mA |
| DC Current (I _{Rbias}) | | | 1.6 | | mA |
| Noise Figure | 0.05 | | 1.3 | — | dB |
| | 0.5 | | 0.6 | — | |
| | 1.0 | | 0.8 | — | |
| | 2.0 | | 1.0 | 1.3 | |
| | 3.0 | | 1.3 | — | |
| | 4.0 | | 1.5 | — | |
| | 5.0 | | 2.0 | — | |
| Gain | 0.05 | — | 24.2 | — | dB |
| | 0.5 | — | 22.1 | — | |
| | 1.0 | — | 18.6 | — | |
| | 2.0 | 12.3 | 13.7 | 15.1 | |
| | 3.0 | — | 10.6 | — | |
| | 4.0 | — | 8.5 | — | |
| | 5.0 | — | 6.7 | — | |
| Input Return Loss | 0.05-0.5 | | 8.8 | | dB |
| | 0.5-6 | | 6.5 | | |
| Output Return Loss | 0.05-0.1 | | 14.0 | | dB |
| | 0.1-6 | | 19.0 | | |
| Output IP3 | 0.05 | | 27.3 | | dBm |
| | 0.5 | | 27.9 | | |
| | 1.0 | | 29.0 | | |
| | 2.0 | | 30.8 | | |
| | 3.0 | | 31.4 | | |
| | 4.0 | | 30.8 | | |
| | 5.0 | | 31.8 | | |
| Output Power @ 1 dB compression ⁽²⁾ | 0.05 | | 17.0 | | dBm |
| | 0.5 | | 17.0 | | |
| | 1.0 | | 17.0 | | |
| | 2.0 | | 16.9 | | |
| | 3.0 | | 16.8 | | |
| | 4.0 | | 16.9 | | |
| | 5.0 | | 17.4 | | |
| 6.0 | | 17.3 | | | |
| DC Current Variation vs. Temperature ⁽³⁾ | | | -0.030 | | mA/°C |
| Thermal Resistance | | | 128 | | °C/W |

Absolute Maximum Ratings⁽⁴⁾

| Parameter | Ratings |
|--------------------------------------|----------------|
| Operating Temperature ⁽⁵⁾ | -40°C to 85°C |
| Storage Temperature | -55°C to 100°C |
| Channel Temperature | 150°C |
| DC Voltage (Pad 6) | 5V |
| Power Dissipation | 500mW |
| DC Current (Pad 6) | 80mA |
| Bias Current (Pad 7) | 10mA |
| Input Power ⁽⁷⁾ | 20dBm |

- ⁽¹⁾ Measured on Mini-Circuits Characterization test board TB-502+ See Characterization Test Circuit (Fig. 1)
- ⁽²⁾ P1dB specified with external current limiting of 40mA; Capable of higher P1dB at higher current (see Fig.2)
- ⁽³⁾ (Current at 85°C - Current at -45°C)/130
- ⁽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.
- ⁽⁶⁾ Specified DC current consumption is under small signal conditions. Current will increase with input RF Power. To maintain maximum current consumption, external DC current limiting circuits are required on Vd line.
- ⁽⁷⁾ Maximum input power is specified based upon external Vd current limiting of 60mA. Maximum input power will degrade without external current limiting.

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Characterization Test Circuit

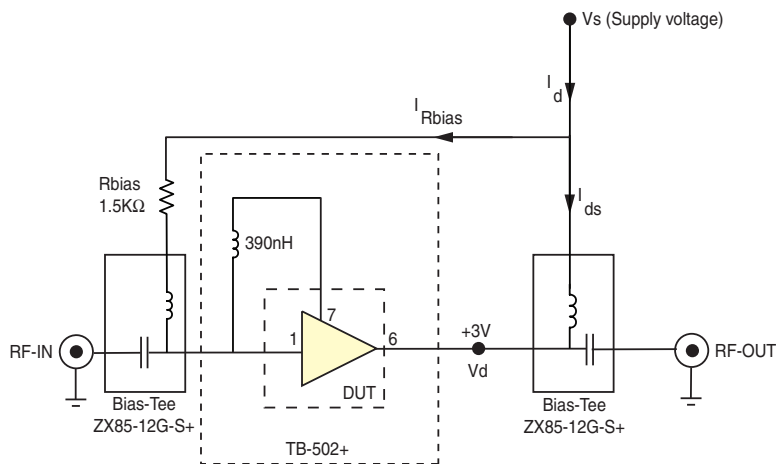


Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization Test Board TB-502+) Gain, Output power at 1dB compression (P1dB), Output IP3 (OIP3) and Noise Figure measured using Agilent's N5242A PNA-X Microwave network analyzer.

Conditions:

1. Gain: Pin=-25 dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 5 dBm/tone at output.
3. Vs adjusted for 3V at device (Vd), compensating loss of bias tee.

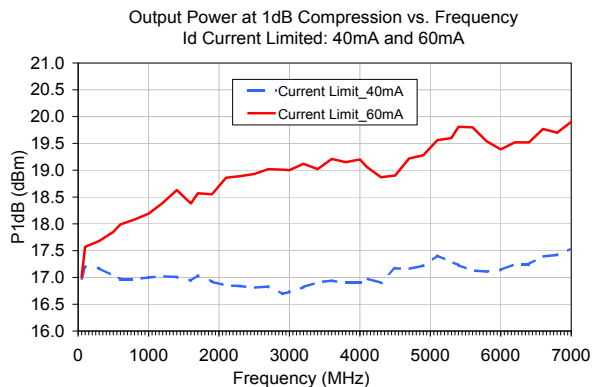
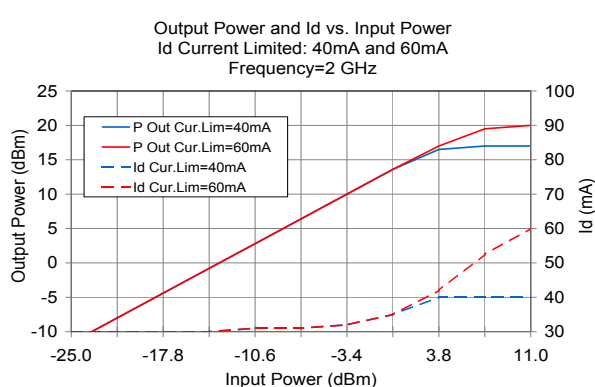


Fig 2. Output Power and Id vs. Input Power and Frequency. Performance measured on Mini-Circuits Characterization test board TB-502+. See Characterization Test Circuit (Fig. 1) Measurements performed with current (Id) limited as noted.

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Recommended Application Circuit

(refer to evaluation board for PCB Layout and component values)

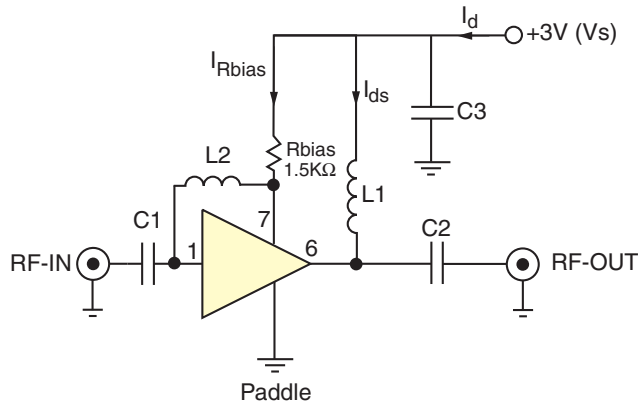


Fig 3. Recommended Application Circuit
 Note: Resistance of L1, 0.1-0.2Ω typically

Typical Current (I_d) as a function of R_{bias}
 ($V_d = 3V$)

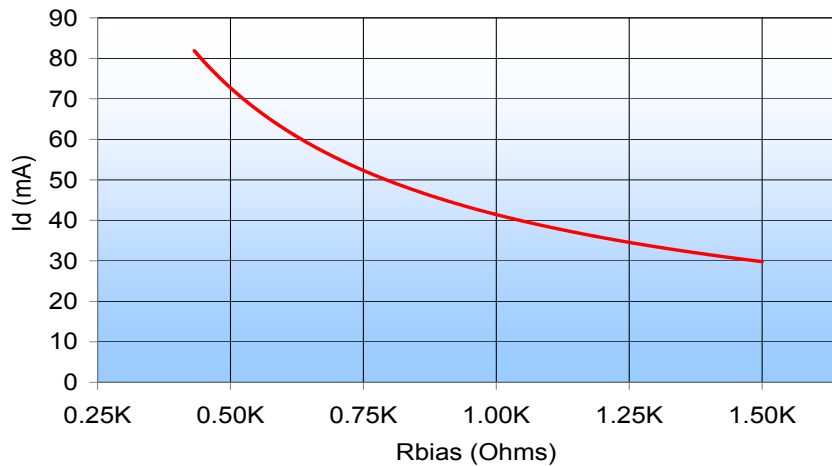


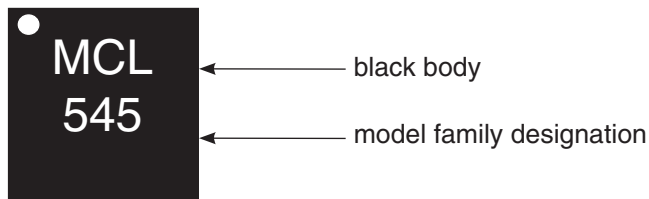
Fig 4. I_d varies as a function of R_{bias} . The I_d current range is defined based upon the specific R_{bias} value noted in the Application Circuit (Fig 3). R_{bias} may be adjusted to optimize I_d for a customers' application. RF performance will vary accordingly.

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Product Marking



Additional Detailed Technical Information

Additional information is available on our web site www.minicircuits.com. To access this information enter the model number on our web site home page.

Performance data, graphs, s-parameter data set (.zip file)

Case Style: DQ849

Plastic package, exposed paddle, lead finish: tin-silver over nickel

Tape & Reel: F104

Standard quantities available on reel: 7" reels with 20, 50, 100, 200, 500, 1K, or 2K devices.

Suggested Layout for PCB Design: PL-299

Evaluation Board: TB-501-1+ (50-5000 MHz)

Environmental Ratings: ENV08T1

ESD Rating

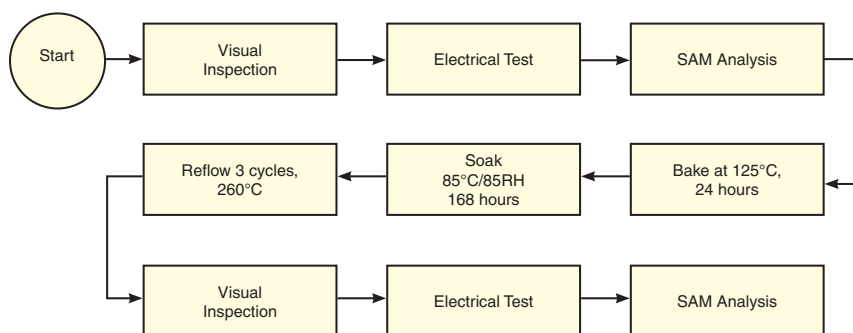
Human Body Model (HBM): Class 1A (250V to <500V) in accordance with ANSI/ESD STM 5.1 - 2001

Machine Model (MM): Class M1 (<100V) in accordance with ANSI/ESD STM5.2-1999; passes 40V

MSL Rating

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D

MSL Test Flow Chart



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