



Mini-Circuits

HIGH DIRECTIVITY

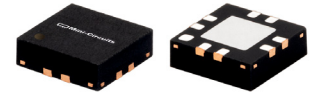
# Monolithic Amplifier

**MNA-6A+**

50Ω 0.5 to 2.5 GHz

## THE BIG DEAL

- Integrated matching, DC Blocks and bias circuits
- High directivity, 13-22 dB typ.
- Excellent Active Directivity
- Operates over 2.8-5V
- Choice of supply voltage, 2.8V to 5V
- Micro-miniature size .120"X.120"
- Internal DC blocking at RF input and output
- Low noise figure, 2.7 dB typ. at 2 GHz
- Output power, up to +20 dBm typ.
- Aqueous washable



Generic photo used for illustration purposes only

CASE STYLE: DQ849

### +RoHS Compliant

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

## APPLICATIONS

- Buffer amplifier
- Cellular
- PCN
- Communications satellite
- Defense

## PRODUCT OVERVIEW

MNA-6A+ is a wideband PHEMT based MMIC amplifier with high active Directivity. MNA integrates the entire matching network and majority of the bias circuit inside the package, reducing the need for complicated external circuits. This approach makes the MNA amplifier extremely straightforward to use. This design operates on a single 2.8 to 5V supply, is well matched for 50Ω and comes in a tiny, low profile 3x3mm 8-lead MCLP package accommodating dense circuit board layouts.

## KEY FEATURES

| Feature   | Advantages  |
|---|---|
| Excellent Active Directivity (Isolation- Gain) 13-22 dB | Ideal for use as a buffer amplifier minimizing interaction of adjacent circuits   |
| Integrates DC blocks and RF choke                       | Minimizes external components, component count and circuit area.  |
| Single 2.8 to +5V operation                             | Amplifier can be used at low voltage such as +3V or standard +5V. +5V operation results in higher P1dB and OIP3.                              |
| 3 x 3mm 8-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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## Monolithic Amplifier

MNA-6A+

ELECTRICAL SPECIFICATIONS<sup>1</sup> AT 25°C

| Parameter   | Condition (GHz)                         | Min. | Vs=5V<br>Typ.                                | Max. | Vs=2.8V<br>Typ.                              | Units |
|---|---|------|--|------|--|-------|
| Frequency Range   |   | 0.5  |  | 2.5  | 0.5-2.5                                      | GHz   |
| Gain  | 0.5<br>0.75<br>1.0<br>1.5<br>2.0<br>2.5 | 22.3 | 22.3<br>24.4<br>25.0<br>25.3<br>24.8<br>23.2 | 27.3 | 20.4<br>22.0<br>22.3<br>22.3<br>21.6<br>20.4 | dB    |
| Input Return Loss                                       | 0.5<br>0.75<br>1.0<br>1.5<br>2.0<br>2.5 |      | 6.3<br>10.9<br>14.2<br>17.4<br>17.6<br>14.9  |      | 6.9<br>11.2<br>13.9<br>16.3<br>17.5<br>15.4  | dB    |
| Output Return Loss                                      | 0.5<br>0.75<br>1.0<br>1.5<br>2.0<br>2.5 |      | 10.9<br>17.8<br>27.2<br>24.1<br>19.5<br>19.4 |      | 9.8<br>13.3<br>14.9<br>15.3<br>14.8<br>15.2  | dB    |
| Output Power at P1dB                                    | 0.5<br>0.75<br>1.0<br>1.5<br>2.0<br>2.5 |      | 20.3<br>20.3<br>20.2<br>19.9<br>19.4<br>19.2 |      | 11.1<br>11.6<br>11.9<br>11.8<br>12.2<br>12.5 | dBm   |
| Output IP3  | 0.5<br>0.75<br>1.0<br>1.5<br>2.0<br>2.5 |      | 33.2<br>33.0<br>32.4<br>31.4<br>30.4<br>30.0 |      | 22.8<br>23.3<br>23.7<br>23.5<br>23.8<br>24.1 | dBm   |
| Noise Figure (dB)                                       | 0.5<br>0.75<br>1.0<br>1.5<br>2.0<br>2.5 |      | 3.1<br>2.8<br>2.6<br>2.6<br>2.7<br>2.7       |      | 3.2<br>2.9<br>2.7<br>2.7<br>2.7<br>2.8       | dB    |
| Directivity (Isolation-Gain)                            | 0.5<br>0.75<br>1.0<br>1.5<br>2.0<br>2.5 |      | 22.1<br>21.1<br>18.7<br>15.1<br>13.3<br>13.2 |      | 24.9<br>22.0<br>19.2<br>15.5<br>13.6<br>13.0 | dB    |
| DC Current  |   |      | 99   | 110  | 92   | mA    |
| Device Current Variation vs. Temperature <sup>(2)</sup> |   |      | 41   |      | 37   | μA/°C |
| Device Current Variation vs Voltage                     |   |      | 0.0017 <sup>(3)</sup>                        |      | 0.0044 <sup>(4)</sup>                        | mA/mV |
| Thermal resistance at 85°C (Junction to Lead)           |   |      | 46   |      | 46   | °C/W  |

(1) Measured on Mini-Circuits Characterization test board TB-186+. See Characterization Test Circuit (Fig. 1)

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

(3) (Current at 5.25V - Current at 3.9V)/1.35

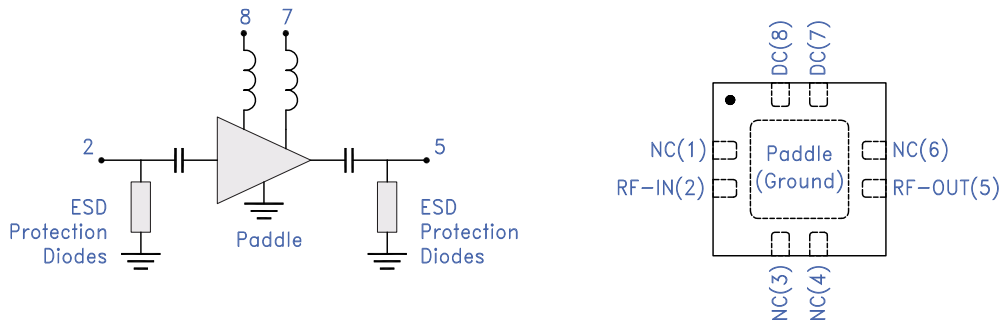
(4) (Current at 3.9V - Current at 2.66V)/1.24

MAXIMUM RATINGS<sup>5</sup>

| Parameter             | Ratings   |
|-----------------------|---|
| Operating Temperature | -40°C to 85°C   |
| Storage Temperature   | -55°C to 100°C  |
| DC Voltage            | 7V at pad 7 (on TB-186+)<br>1V at pads 2 & 5          |
| Power Dissipation     | 970 mW  |
| Input Power           | 10dBm (continuous operation)<br>26dBm (5 minutes max) |

5. Permanent damage may occur if any of these limits are exceeded. These ratings are not intended for continuous normal operation.

## SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION



| Function | Pad Number | Description (See Fig 1)  |
|----------|------------|--|
| RF-IN    | 2          | RF input pin   |
| RF-OUT   | 5          | RF output pin  |
| DC       | 7,8        | DC Bias pads 7,8. Pad 7 connected to ground via 1000 pF. Pad 8 connected to pad 7 via 33 ohms. |
| NC       | 1,3,4,6    | Not Connected, connect pad 3 and 4 to ground externally  |
| GND      | Paddle     | Ground   |
| OPTIONAL | 1,6        | No internal connection; recommended use: per PCB Layout PL-078                                 |



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# Monolithic Amplifier

**MNA-6A+**

## CHARACTERIZATION & APPLICATION TEST CIRCUIT

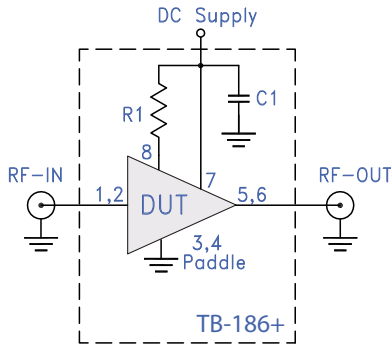


Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-313)

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.

| Component | Size | Value | Units    |
|-----------|------|-------|----------|
| R1        | 0805 | 33.2  | $\Omega$ |
| C1        | 0402 | 1000  | pF       |

## RECOMMENDED APPLICATION CIRCUIT

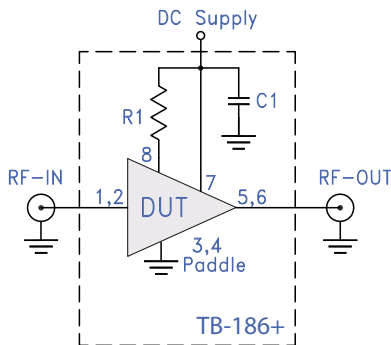
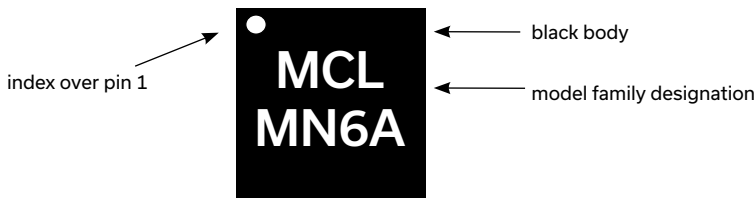


Fig 2. Test Board includes case, connectors, and components soldered to PCB

| Component | Size | Value | Units    |
|-----------|------|-------|----------|
| R1        | 0805 | 33.2  | $\Omega$ |
| C1        | 0402 | 1000  | pF       |

## PRODUCT MARKING



Marking may contain other features or characters for internal lot control





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

|  |   |
|--|---|
| Performance Data                                     | Data Table<br>Swept Graphs<br>S-Parameter (S2P Files) Data Set (.zip file)      |
| Case Style   | DQ849 3x3x0.9 mm MCLP Plastic package, exposed paddle<br>lead finish: Matte-Tin |
| Tape & Reel<br>Standard quantities available on reel | F104<br>7" reels with 20, 50, 100, 200, 500, 1K, or 2K devices                  |
| Suggested Layout for PCB Design                      | PL-078  |
| Evaluation Board                                     | TB-186-6A+  |
| Environmental Ratings                                | ENV08T1   |

#### ESD RATING

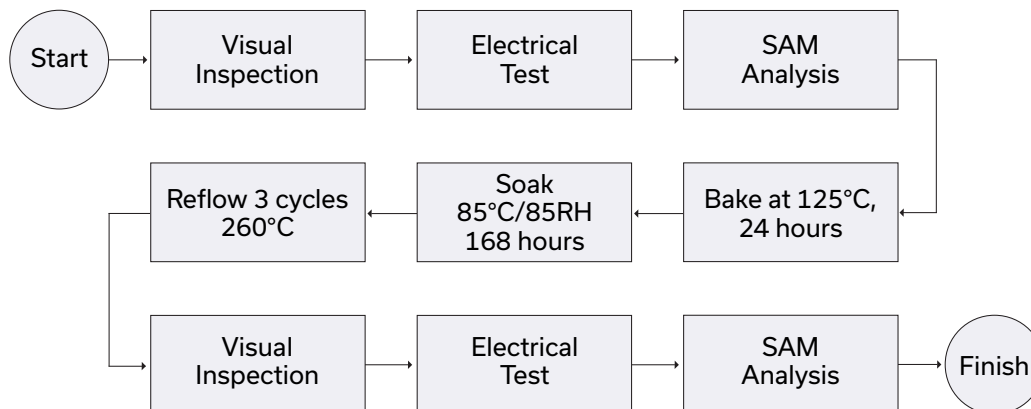
Human Body Model (HBM): Class 1A (250 to <500V) in accordance with ANSI/ESD STM 5.1 - 2001

Machine Model (MM): Class M1 (>25V) in accordance with ANSI/ESD STM5.2-1999

#### MSL RATING

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

#### MSL TEST FLOW CHART



#### NOTES

- 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.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- 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)

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