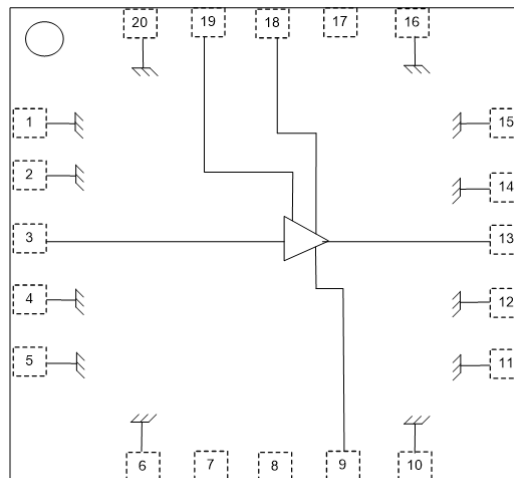


## Features:

- Frequency Range: 0.1 – 20 GHz
- P3dB: +29 dBm
- Gain: 12.5 dB
- Vdd = 12 V
- Ids = 500 mA
- Input and Output Fully Matched to 50  $\Omega$

## Applications:

- Fiber optics communication systems
- Microwave and wireless communication systems
- Microwave and optical instrumentations
- Military and EW equipments



Functional block diagram

## Description:

The MMA-012030-M4 is a broadband GaAs MMIC Traveling Wave Amplifier (TWA) with high output power and high gain over 0.1 to 20GHz frequency range. This amplifier is optimally designed for broadband high power applications requiring flat gain and high output power with excellent input and output matches over a 0.1 to 20GHz frequency range.

## Absolute Maximum Ratings: ( $T_a = 25^\circ\text{C}$ )\*

| SYMBOL  | PARAMETERS                      | UNITS            | Min. | Max.        |
|---------|---------------------------------|------------------|------|-------------|
| Vds     | Drain-Source Voltage            | V                |      | 12.5        |
| Vg1     | First Gate-Source Voltage       | V                | -2   | 0           |
| Ig1     | First Gate Current              | mA               | -10  | 1           |
| Vg2     | Second Gate-Source Voltage      | V                | -3.5 | 7           |
| Ig2     | Second Gate-Source Current      | mA               | -20  |             |
| Pdiss   | Maximum Power Dissipation       | W                |      | 8           |
| Pin max | RF Input Power                  | dBm              |      | 24          |
| Toper   | Operating Temperature           | $^\circ\text{C}$ |      | -40 to +85  |
| Tch     | Channel Temperature             | $^\circ\text{C}$ |      | +150        |
| Tstg    | Storage Temperature             | $^\circ\text{C}$ |      | -55 to +165 |
| Tmax    | Max. Assembly Temp (60 sec max) | $^\circ\text{C}$ |      | +300        |

\*Operation of this device above any one of these parameters may cause permanent damage.



# MMA-012030-M4

## 0.1-20GHz 1W Traveling Wave Amplifier

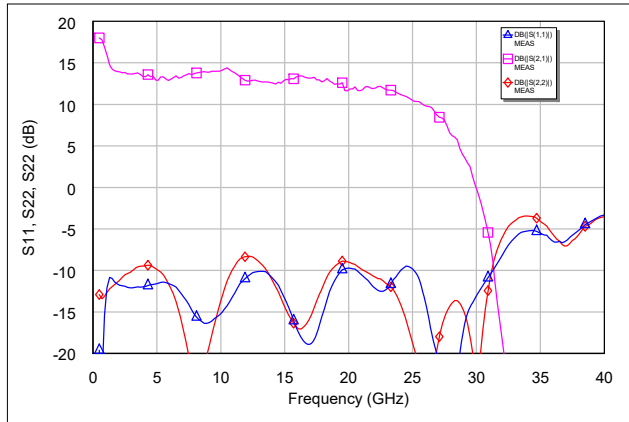
### Data Sheet

#### Electrical Specifications: *V<sub>ds</sub>=12V, V<sub>g1</sub>=-0.8V, V<sub>g2</sub>=open, I<sub>ds</sub>=500mA, T<sub>a</sub>=25 °C Z<sub>0</sub>=50 ohm*

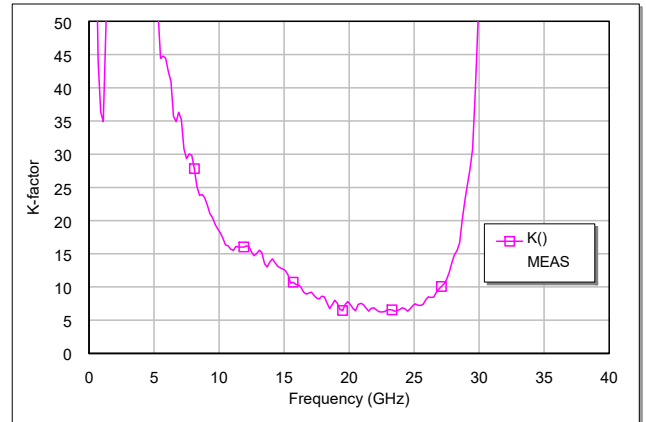
| Parameter                             | Units | Min. | Typ. | Max.   |
|---------------------------------------|-------|------|------|--------|
| Frequency Range                       | MHz   | 0.1  |      | 20,000 |
| Gain (Typ / Min)                      | dB    | 11.5 | 12.5 |        |
| Gain Flatness (Typ / Max)             | +/-dB |      | 0.5  | 0.8    |
| Input RL(Typ / Max)                   | dB    | 9    | 10   |        |
| Output RL(Typ / Max)                  | dB    | 8    | 10   |        |
| Output P1dB(Typ / Min)                | dBm   | 26.5 | 27   |        |
| Output IP3 <sup>(1)</sup>             | dBm   |      | 37   |        |
| Output P3dB(Typ / Min)                | dBm   | 28.5 | 29   |        |
| Operating Current at P1dB (Typ / Max) | mA    |      | 500  | 550    |
| Thermal Resistance                    | °C /W |      | 8    |        |

(1) Output IP3 is measured with two tones at output power of 10 dBm/tone separated by 20 MHz.

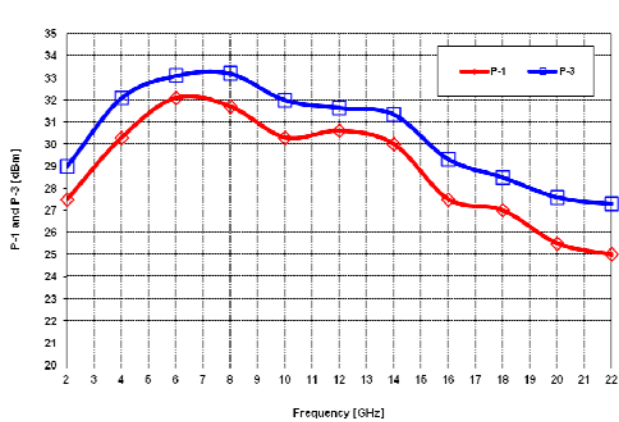
### Typical RF Performance: $V_{ds}=12V$ , $V_{g1}=-0.75V$ , $V_{g2}=2V$ , $I_{ds}=500mA$ , $Z_0=50\ \Omega$ , $T_a=25\ ^\circ C$



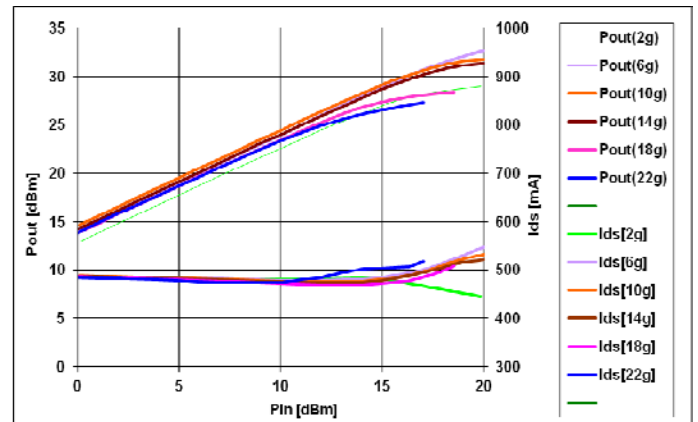
S11, S21, and S22 vs. Frequency



K-factor vs. Frequency



P-1 and P-3 vs. Frequency



Pout, and Ids vs. Pin

### Applications

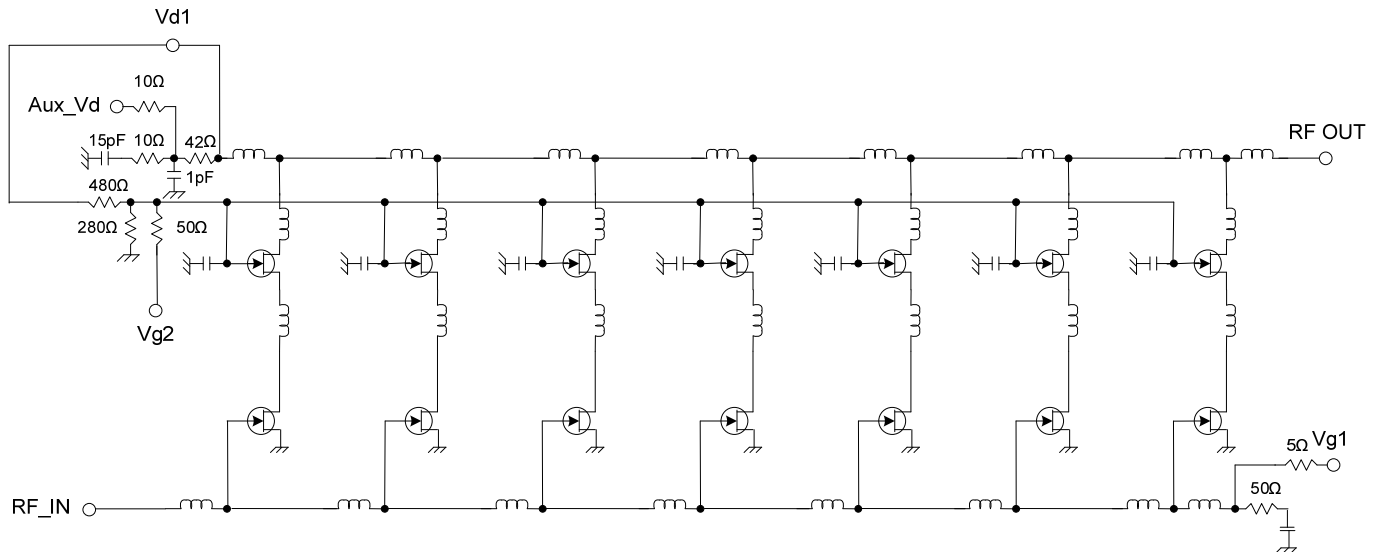
The MMA-012030-M4 traveling wave amplifier is designed for use as a general purpose wideband power stage in microwave communication systems, and test equipments. It is ideally suited for broadband applications requiring a flat gain response and excellent port matches over a 0.1 to 20 GHz frequency range.

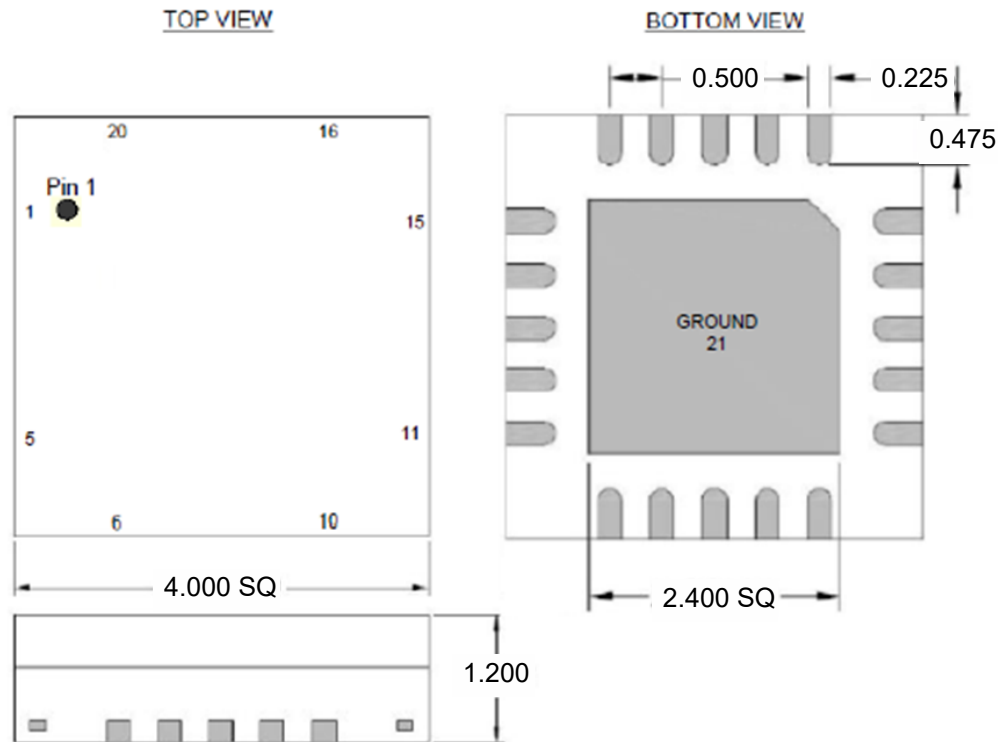
### Biasing and Operation

The recommended bias conditions for best performance for the MMA-012030-M4 are  $V_{DD} = 12V$ ,  $I_{DD} = 500mA$ . To achieve these drain current levels,  $V_{g1}$  is typically  $-0.8V$ , and  $V_{g2}$  is  $+2V$ . No other bias supplies or connections to the device are required for 0.1 to 20 GHz operation. The gate voltage ( $V_{g1}$ ) should be applied prior to the drain voltage ( $V_{d1}$ ) during power up and removed after the drain voltage during power down. The MMA-012030-M4 is a DC coupled amplifier. External coupling capacitors are needed on RFIN and RFOUT ports. The drain bias pad is connected to RF and must be decoupled to the lowest operating frequency. An auxiliary drain contacts is provided when performance below 0.1 GHz is required. Connect external capacitors to ground to maintain input and output VSWR at low frequencies (see additional application note). Do not apply bias to these pads. The second gate ( $V_{g2}$ ) can be used to obtain 30 dB (typical) dynamic gain control. For highest gain operation,  $V_{g2}$  voltage must be set at  $+2V$ .

### Assembly Techniques

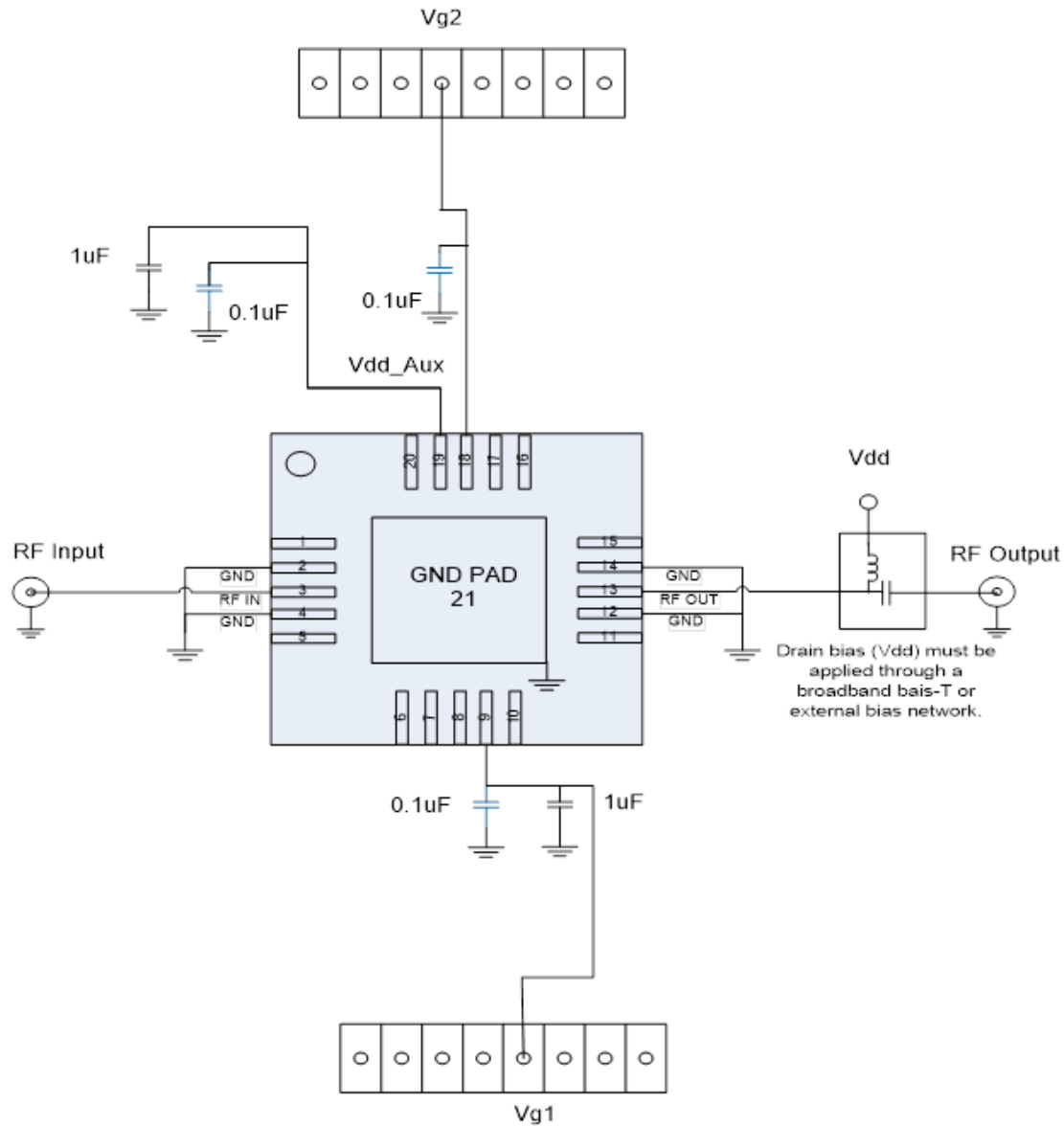
GaAs MMICs are ESD sensitive. ESD preventive measures must be employed in all aspects of storage, handling, and assembly. MMIC ESD precautions, handling considerations, die attach and bonding methods are critical factors in successful GaAs MMIC performance and reliability.

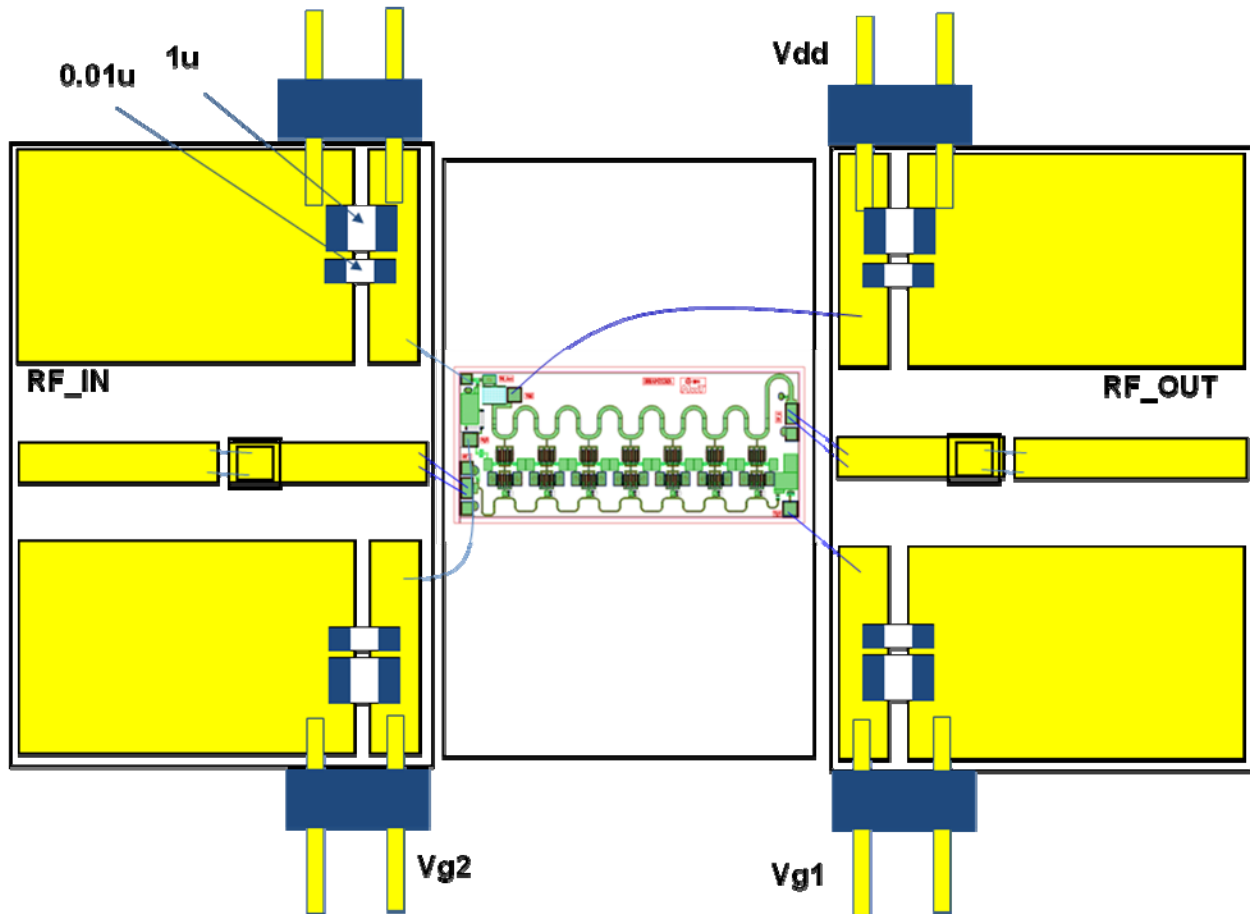




| Pin                                           | Description |
|-----------------------------------------------|-------------|
| 3                                             | RF Input    |
| 13                                            | RF Output   |
| 9                                             | Vg1         |
| 18                                            | Vg2         |
| 19                                            | Vdd_Aux     |
| 1, 2, 4, 5, 6, 10, 11, 12, 14, 15, 16, 20, 21 | Ground      |
| 7, 8, 17                                      | N/C         |

## Application Circuit:





**Demo module DC and RF pin assignment**