

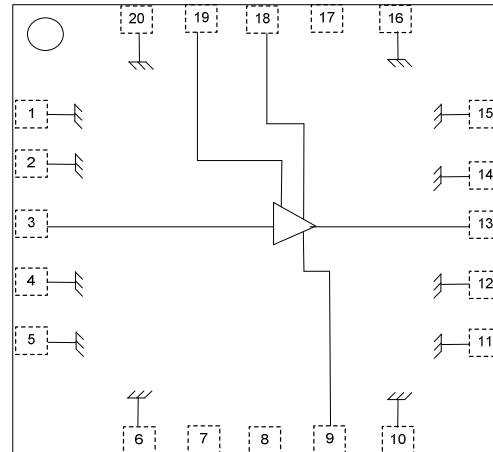
## Features:

- Frequency Range: 30 KHz – 50 GHz \*
- P1dB: +22 dBm
- Vout: 7V p-p @50Ω
- Gain: 13.5 dB
- Vdd = 7 V
- Ids = 200 mA
- Input and Output Fully Matched to 50 Ω
- Surface Mount, RoHs Compliant QFN 4x4mm package

\* NOTE: Performance degradation over 40 GHz

## Applications:

- Fiber optics communication systems
- Microwave and wireless communication systems
- Microwave and optical instrumentations



Functional block diagram

## Description:

The MMA-005022-M4 is a broadband GaAs MMIC Traveling Wave Amplifier (TWA) with medium output power and high gain over full 30KHz to 50GHz frequency range. This amplifier is optimally designed for broadband applications requiring flat gain and group delay with excellent input and output matches over a 30KHz to 50GHz frequency range.

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

SYMBOL	PARAMETERS	UNITS	Min.	Max.
Vds	Drain-Source Voltage	V		10
Vg1	First Gate-Source Voltage	V	-8	0
Ig1	First Gate Current	mA	-38	1
Vg2	Second Gate-Source Voltage	V	-3.5	4
Ig2	Second Gate-Source Current	mA	-20	
Ids	Drain Current	mA		340
Pin max	RF Input Power	dBm		17
Toper	Operating Temperature	°C		-40 to +85
Tch	Channel Temperature	°C		+150
Tstg	Storage Temperature	°C		-55 to +165
Tmax	Max. Assembly Temp (60 sec max)	°C		+300

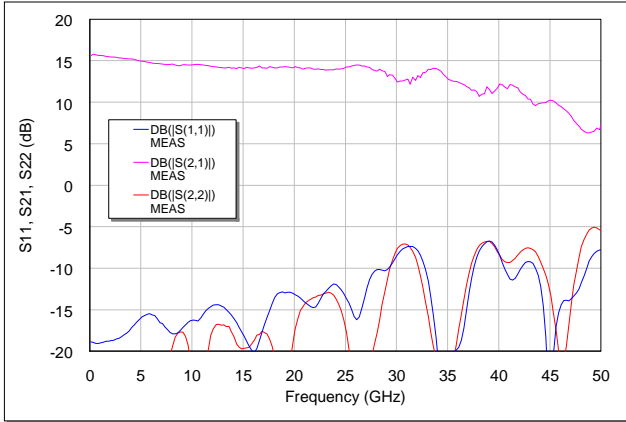
\*Operation of this device above any one of these parameters may cause permanent damage.

**Electrical Specifications:** *V<sub>ds</sub>=7V, V<sub>g1</sub>=-2.7V, V<sub>g2</sub>=open, I<sub>ds</sub>=200mA, T<sub>a</sub>=25 °C Z<sub>0</sub>=50 ohm*

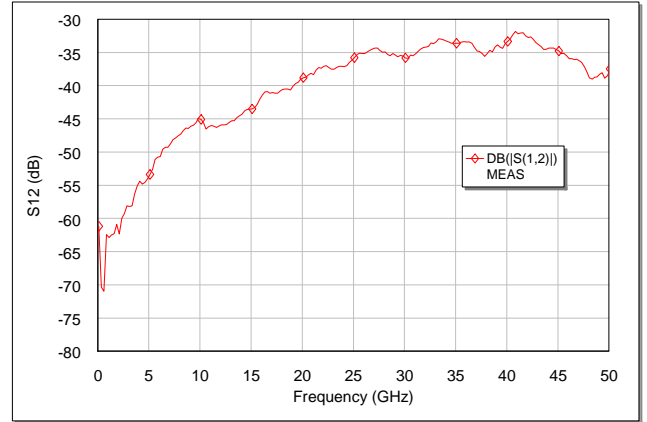
Parameter	Units	Min.	Typ.	Max.
<b>Frequency Range</b>	MHz	0.03		40,000
<b>Gain (Typ/Min)</b>	dB	12	13.5	
<b>Gain Flatness (Typ/Max)</b>	+/-dB		2.0	2.5
<b>Input RL(Typ)</b>	dB		10	
<b>Output RL(Typ)</b>	dB		10	
<b>Output P1dB(Typ)</b>	dBm		22	
<b>Output IP3<sup>(1)</sup>(Typ)</b>	dBm		30	
<b>Output Psat(Typ)</b>	dBm		25	
<b>Operating Current at P1dB (Typ/Max)</b>	mA		210	230
<b>Thermal Resistance</b>	°C /W		16	

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

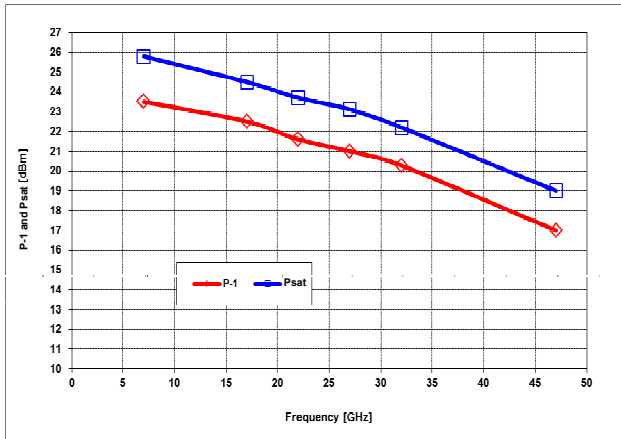
**Typical RF Performance:**  $V_{ds}=7V$ ,  $V_{g1}=-2.7V$ ,  $V_{g2}=open$ ,  $I_{ds}=200mA$ ,  $Z_0=50\ ohm$ ,  $T_a=25\ ^\circ C$



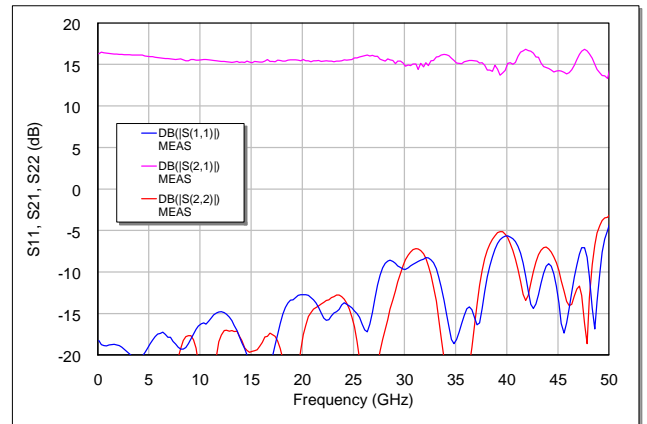
S11, S21, and S22 vs. Frequency



S12(dB) vs. Frequency



P-1 and Psat vs. Frequency



S11, S21, and S22 vs. Frequency

@  $V_{ds}=5V$ ,  $I_{ds}=220mA$

## Applications

The MMA-005022-M4 traveling wave amplifier is designed for use as a general purpose wideband power stage in microwave and optical communication systems, and test fiber optic/microwave test equipments. It is ideally suited for broadband applications requiring a flat gain response and excellent port matches over a 30KHz to 50 GHz frequency range. Dynamic gain control and low-frequency extension capabilities are designed into these devices.

## Biasing and Operation

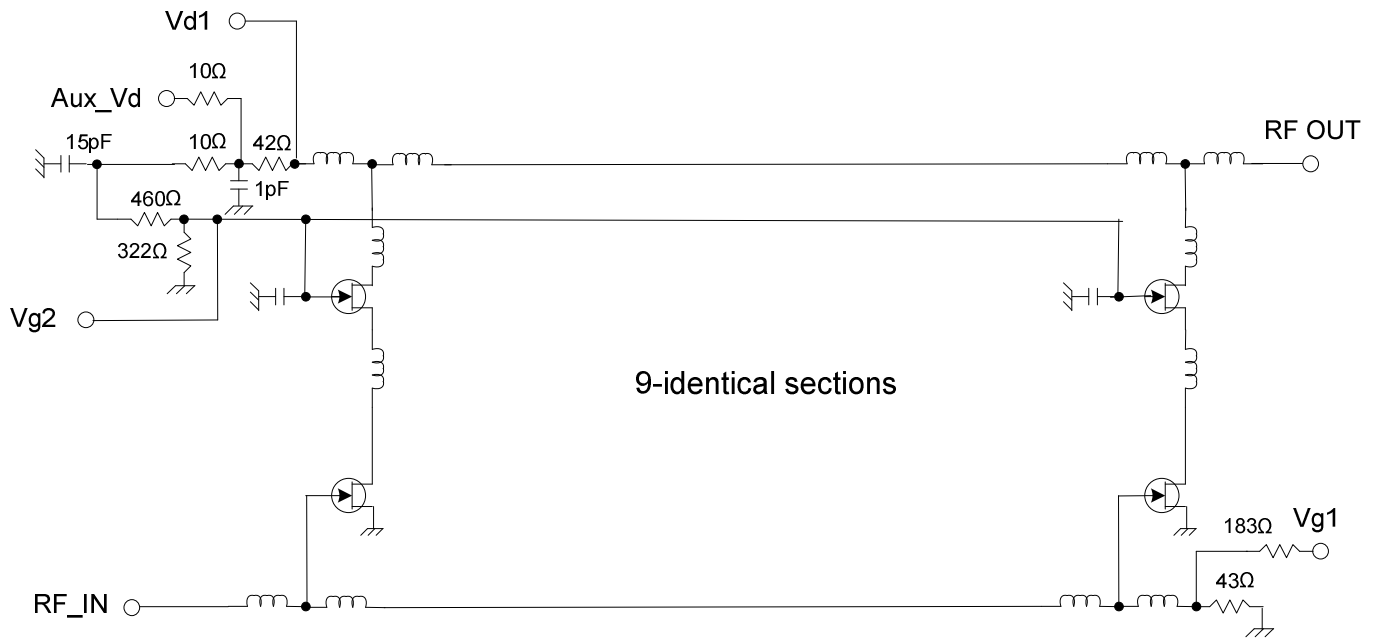
The recommended bias conditions for best performance for the MMA-005022-M4 are  $V_{DD} = 7.0V$ ,  $I_{DD} = 200mA$ . To achieve these drain current levels,  $V_{g1}$  is typically biased between  $-2.7V$  with approximately  $10mA$ . No other bias supplies or connections to the device are required for 30KHz to 50 GHz operation. Performance improvements are possible depending on applications. For high gain requirement at higher frequency, recommended bias conditions are  $V_{dd}=5V$ ,  $I_{dsq}=220mA$ . The drain bias voltage range is 3 to 7V and the quiescent drain current biasing range is 120mA to 250mA. The gate voltage ( $V_{g1}$ ) should be applied prior to the drain voltage ( $V_{dd}$ ) during power up and removed after the drain voltage during power down. The MMA-005022-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 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 normal operation, no external bias is required on this contact.

## Assembly Techniques

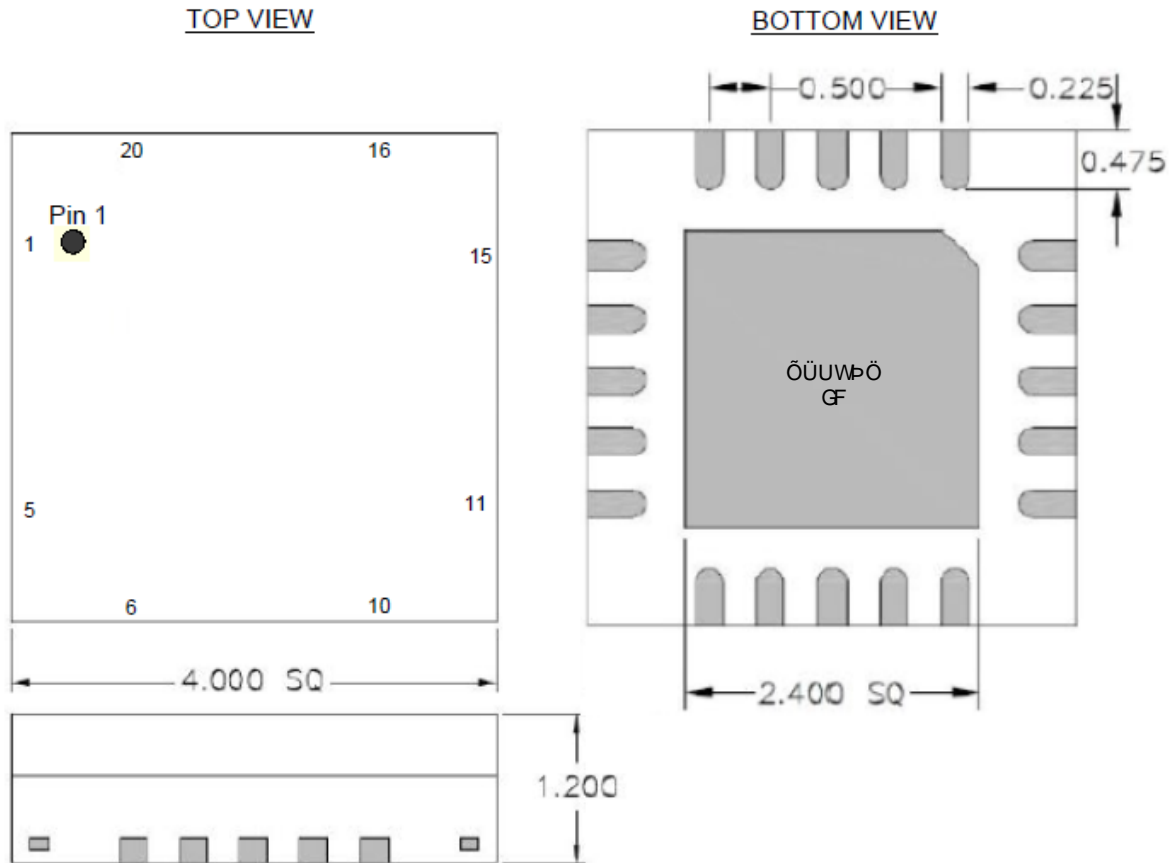
GaAs MMICs are ESD sensitive. ESD preventive measures must be employed in all aspects of storage, handling, and assembly. MMIC ESD precautions, handling considerations, die attach and bonding methods are critical factors in successful GaAs MMIC performance and reliability.

## Additional References:

MMA-005022B Application note v.1.0



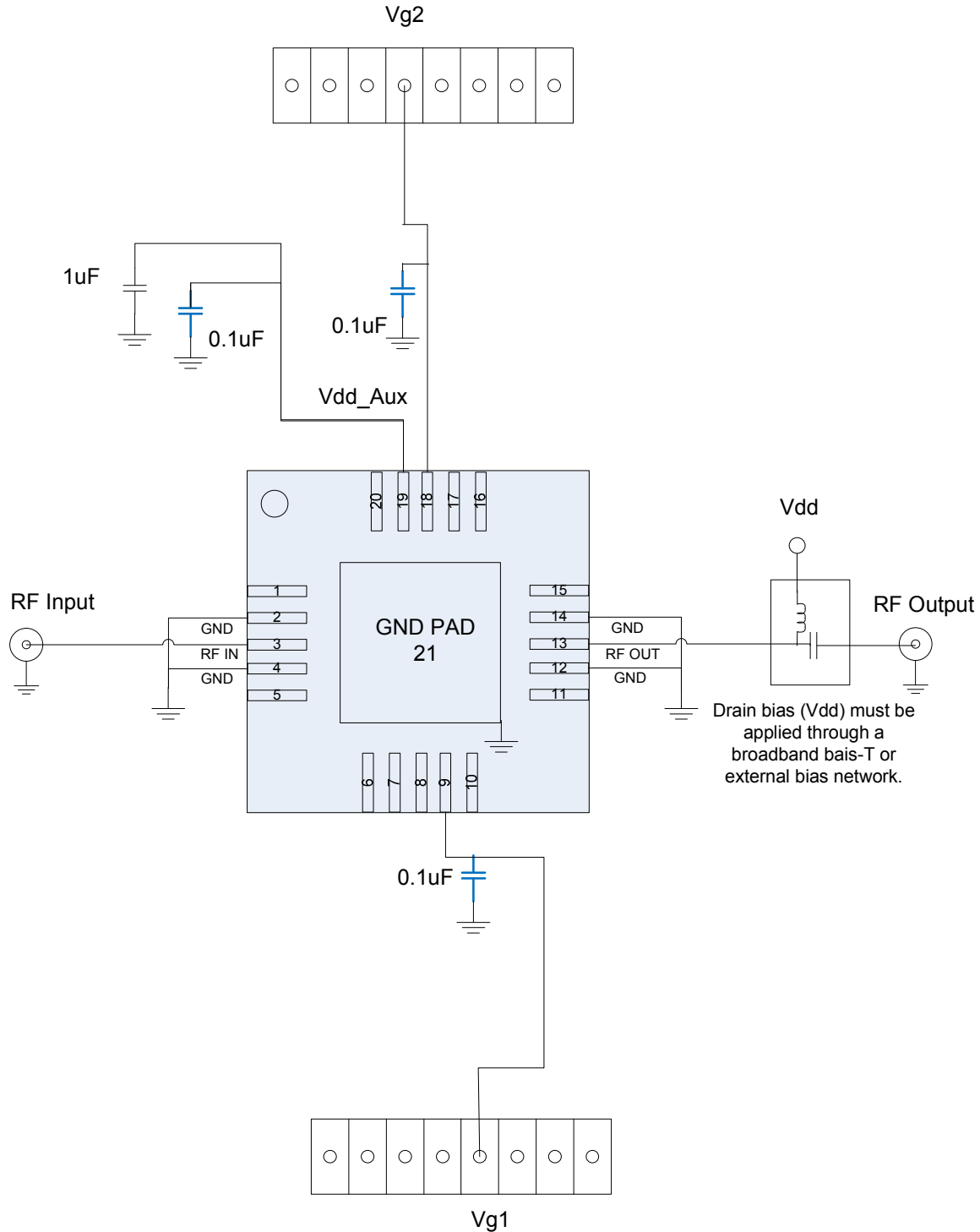
**Package Mechanical information and Pin-out:**



The units are in [mm].

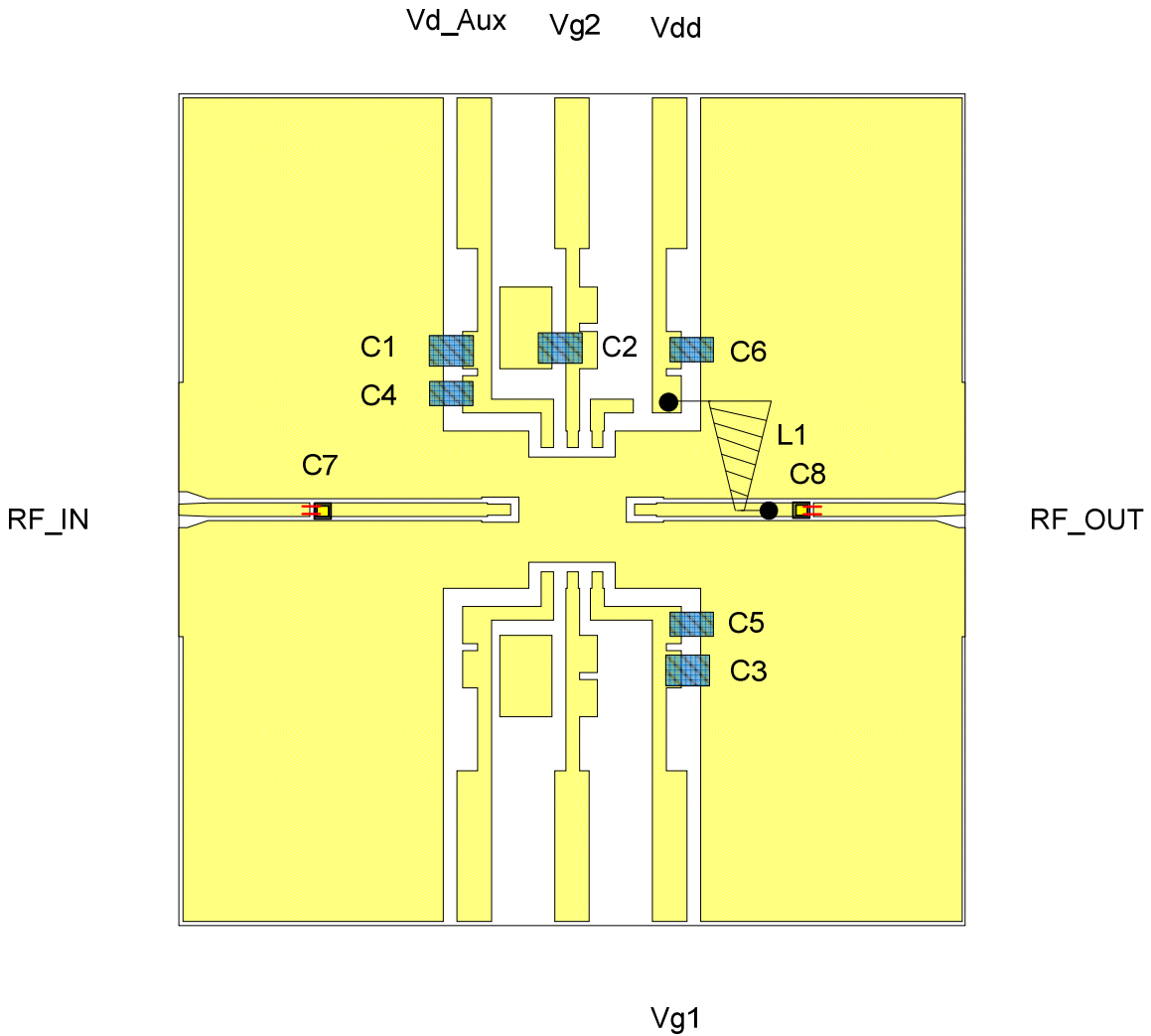
Pin	Description
3	RF Input
13	RF Output /Vdd
9	Vg1
18	Vg2
19	Vdd_Aux
1, 2, 4, 5, 6, 10, 11, 12, 14, 15, 16, 20, 21	Ground
7, 8, 17	N/C

**Application Circuit:**



**Recommended Application Board Design:**

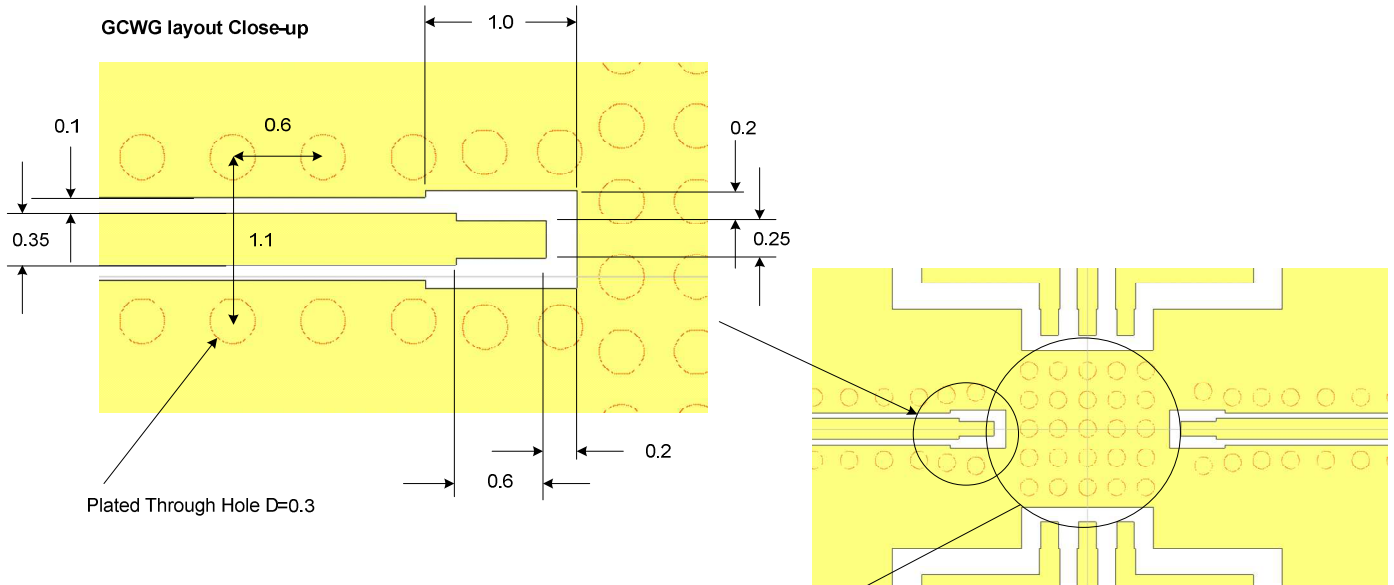
Board Material is 10mil (Dielectric) thickness Rogers 4350B with 0.5oz copper clads.  
Board is soldered on a gold plated solid copper block and adequate heat-sinking is required for 3.4W total maximum power dissipation.



Part	Value	Description
C1, C3	1uF	0603
C2, C4, C5, C6	0.1uF	0402
C7, C8	100pF	Presidio LSB1515B101M2H5R-B
L1	1uH	GOWANDA C100FL3944G6

**Recommended Application Board Design:**

Board Material is 10mil (Dielectric) thickness Rogers 4350B with 0.5oz copper clads. The board material and mounting pattern, as defined in the data sheet, optimizes RF performance and is strongly recommended. An electronic drawing of the land pattern is available upon request from MwT Sales & Application Engineering.



All units are in millimeters.

Underneath of the package must be  
Copper filled plated through holes.  
D=0.3mm and Space=0.5mm  
Total Via-holes = 5 x 5

Copper filled thru vias  
D=0.3mm, Space=0.5mm  
7x7

For best thermal  
dissipation, 3mm square  
Copper filled PCB is  
recommended.

