TRIQUINT SEMICONDUCTOR, INC.

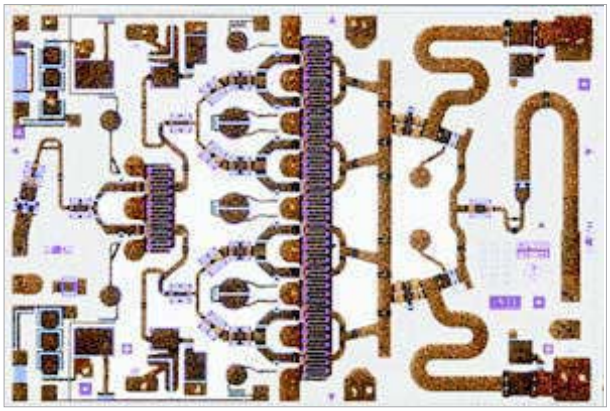
TQS

**TGA9083-EEU**

**Power Amplifier** **9083**

- **6.5 to 11.5-GHz Frequency Range**
- **5-Watt Output Power at 7V , 6-W at 8V, 8-W at 9 Volt Drain Bias**
- **19-dB Typical Small Signal Gain**
- **40% Power Added Efficiency at 7V, 35% PAE at 9 Volt Drain Bias**
- **12-dB Typical Input Return Loss, 9-dB Typical Output Return Loss**
- **On-Chip Active Gate Bias Circuit Option Simplifies Biasing**
- **4, 521 x 3,048 x 0,100 mm (0.178 x 0.120 x 0.004 in.)**

**PHOTO ENLARGEMENT**



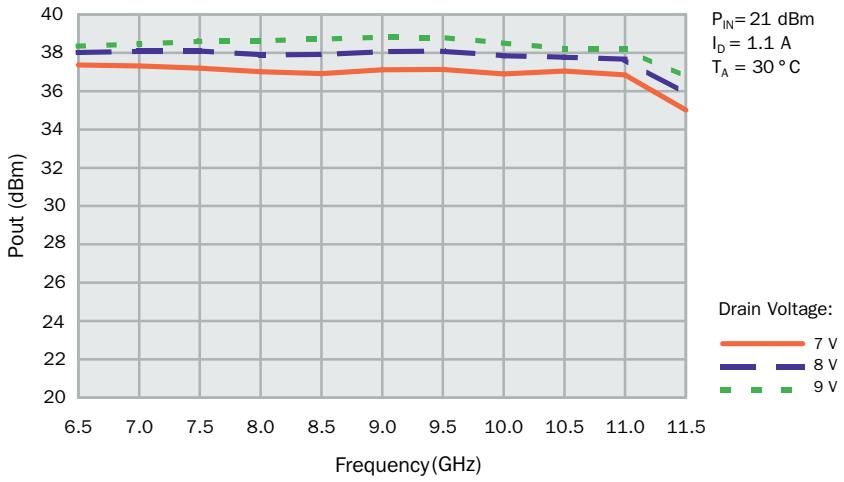
**DESCRIPTION**

The TriQuint TGA9083 -EEU is a monolithic power amplifier which operates from 6.5 to 11.5 GHz. This device is currently classified as an Engineering Evaluation Unit. This t wo stage power amplifier partially consists of a 2.5-mm pHEMT driving a 11.36-mm pHEMT at the output. The TGA9083-EEU is capable of providing 8 Watts of output power with 35% PAE when biased at 9 Volts. Typical 7 Volts operation provides 5 Watts of output power with a power-added efficiency of 40 percent. Typical small signal gain is 19-dB. In balanced configuration, 12 Watts of output power is achievable with 40% PAE.

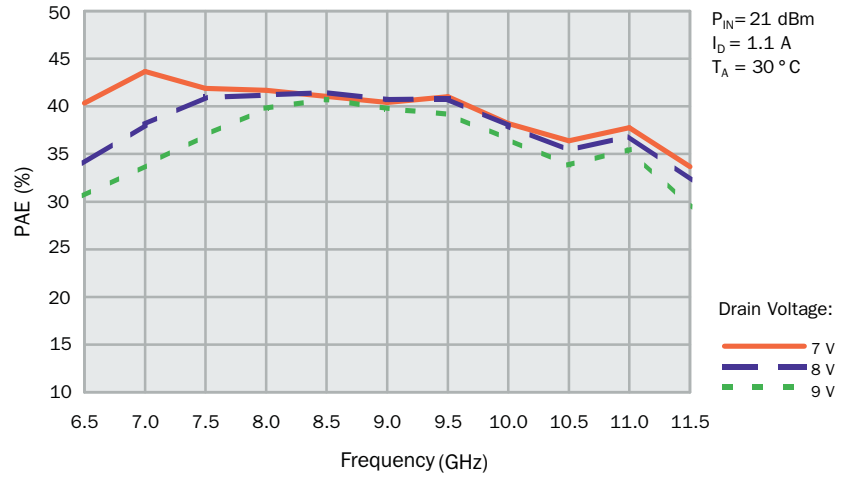
The TGA9083-EEU is fabricated using TI's 0.25um T-gate power pHEMT process. This device offer s either standard gate biasing or an on-chip active gate bias circuit which simplifies gate biasing. The active gate bias (AGB) circuit requires a -5 V supply. This amplifier's output power and high efficiency over 6.5 to 11.5 GHz make it a viable power amp solution in applications such as point-to-point radio , phased-array radar, and telecommunications.

Bond pad and backside metallization is gold plated for compa tibility with eutectic alloy attachment methods as well as with thermocompression and thermosonic wire-bonding processes.
The TGA9083-EEU is supplied in chip for m and is readily assembled using automated equipment. Ground is provided to the circuitry through vias to the backside metallization.

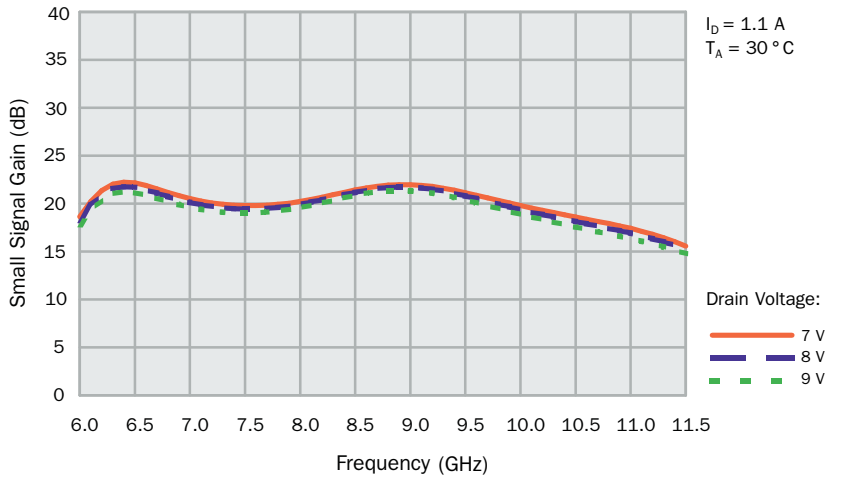
**TYPICAL OUTPUT POWER**



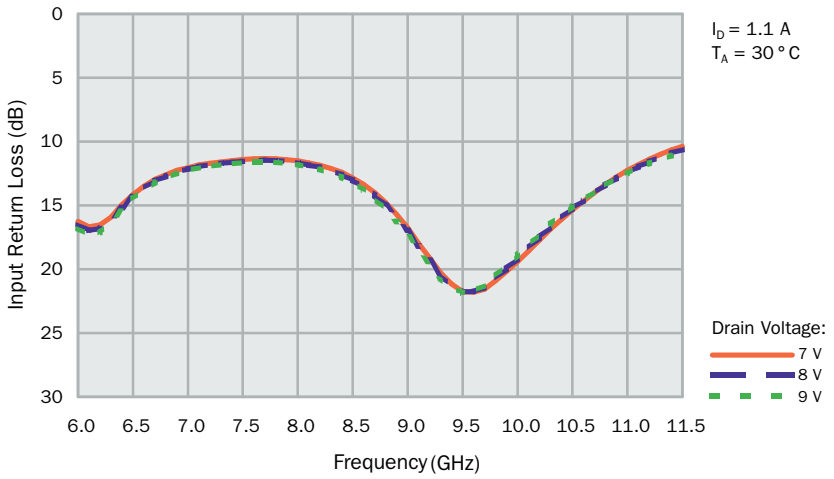

**TYPICAL POWER-ADDED EFFICIENCY**



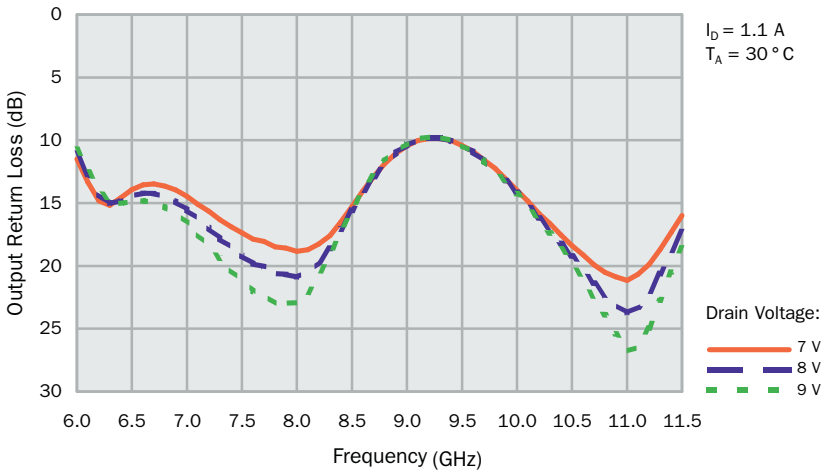

**TYPICAL SMALL SIGNAL GAIN**



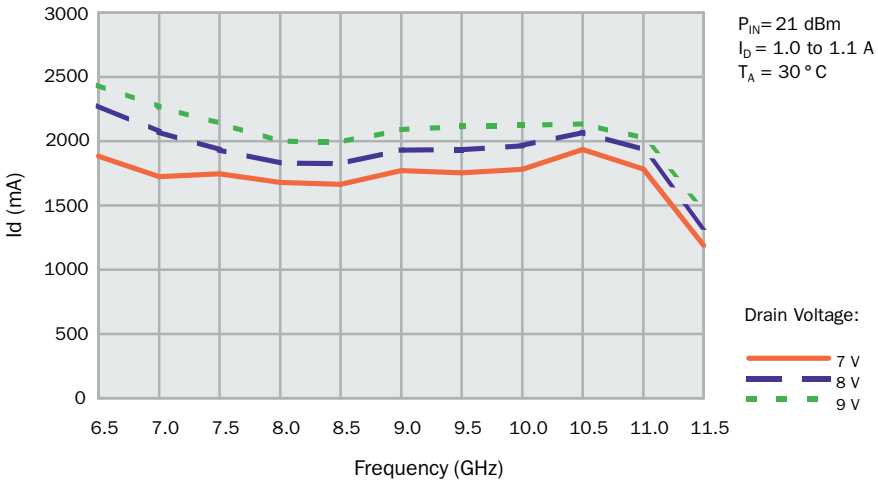
**TYPICAL**
**INPUT RETURN LOSS**




**TYPICAL**
**OUTPUT RETURN LOSS**




**TYPICAL**
**DRAIN CURRENT**



## ABSOLUTE MAXIMUM RATINGS

| | |
|---|---|
| Drain supply voltage, $V_D$ | 10 V |
| Negative supply voltage range, $V_G$ | -5 V to 0 V |
| Drain supply current, $I_D$ | 3.5 A |
| Power dissipation, $P_D$, at (or below) 25 C base-plate temperature* | 39 W |
| Input continuous wave power, $P_{IN}$ | 25.5 dBm |
| Operating channel temperature, $T_{CH}$** | 150 C |
| Mounting temperature (30 sec), $T_M$ | 320 C |
| Storage temperature range, $T_{STG}$ | -65 to 150 C |

**Ratings over operating channel temperature range, $T_{CH}$ (unless otherwise noted)**

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "RF Characteristics" is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

* For operation above 25 C base-plate temperature, derate linearly at the rate of 73 mW/ C.

** Operating channel temperature directly affects the device MTTF. For maximum life, it is recommended that channel temperature be maintained at the lowest possible level.

## TYPICAL S-PARAMETERS

| Frequency | S11 | | S21 | | S12 | | S22 | |
|---|---|---|---|---|---|---|---|---|
| (GHz) | dB | ANG(°) | dB | ANG(°) | dB | ANG(°) | dB | ANG(°) |
| 6.5 | -14.31 | -78.1 | 21.77 | 168.2 | -64.33 | 88.1 | -14.44 | 114.4 |
| 6.6 | -13.64 | -94.1 | 21.69 | 146.0 | -60.56 | 81.2 | -14.21 | 89.3 |
| 6.7 | -13.08 | -107.7 | 21.42 | 125.7 | -58.66 | 70.2 | -14.24 | 69.1 |
| 6.8 | -12.72 | -118.8 | 21.09 | 107.0 | -57.67 | 59.6 | -14.50 | 50.1 |
| 6.9 | -12.36 | -128.4 | 20.74 | 89.7 | -57.01 | 48.2 | -14.91 | 34.3 |
| 7.0 | -12.15 | -136.9 | 20.40 | 73.4 | -56.72 | 37.4 | -15.53 | 17.3 |
| 7.1 | -11.94 | -144.3 | 20.12 | 57.9 | -56.97 | 28.1 | -16.28 | 1.9 |
| 7.2 | -11.81 | -151.0 | 19.88 | 43.1 | -57.08 | 20.2 | -16.99 | -14.2 |
| 7.3 | -11.71 | -157.2 | 19.69 | 28.9 | -57.77 | 11.7 | -17.83 | -30.1 |
| 7.4 | -11.62 | -163.0 | 19.55 | 14.9 | -57.76 | 4.5 | -18.52 | -46.3 |
| 7.5 | -11.54 | -168.6 | 19.48 | 1.3 | -57.76 | -5.0 | -19.16 | -61.9 |
| 7.6 | -11.48 | -174.6 | 19.44 | -12.1 | -57.71 | -14.8 | -19.83 | -75.8 |
| 7.7 | -11.46 | 179.6 | 19.45 | -25.4 | -58.13 | -28.3 | -20.05 | -88.6 |
| 7.8 | -11.49 | 173.5 | 19.51 | -38.6 | -58.49 | -39.3 | -20.59 | -98.0 |
| 7.9 | -11.56 | 167.5 | 19.61 | -51.8 | -58.82 | -50.7 | -20.68 | -105.8 |
| 8.0 | -11.64 | 161.1 | 19.75 | -65.0 | -58.75 | -62.5 | -20.89 | -108.7 |
| 8.1 | -11.84 | 154.7 | 19.93 | -78.4 | -59.10 | -79.3 | -20.52 | -109.5 |
| 8.2 | -12.00 | 148.0 | 20.16 | -92.1 | -59.09 | -95.6 | -19.67 | -108.5 |
| 8.3 | -12.27 | 140.8 | 20.41 | -106.1 | -59.22 | -113.4 | -18.60 | -107.9 |
| 8.4 | -12.59 | 133.2 | 20.67 | -120.4 | -58.89 | -133.1 | -17.09 | -109.5 |
| 8.5 | -13.03 | 124.8 | 20.93 | -135.0 | -58.80 | -149.5 | -15.59 | -112.4 |
| 8.6 | -13.55 | 115.8 | 21.18 | -150.0 | -58.78 | -170.2 | -14.14 | -117.2 |
| 8.7 | -14.20 | 106.2 | 21.39 | -165.3 | -58.42 | 173.1 | -12.89 | -124.4 |
| 8.8 | -15.00 | 95.7 | 21.56 | 179.2 | -58.06 | 152.0 | -11.82 | -132.0 |
| 8.9 | -15.96 | 84.3 | 21.67 | 163.6 | -57.95 | 133.7 | -10.98 | -141.0 |
| 9.0 | -16.95 | 72.4 | 21.72 | 147.9 | -57.57 | 114.0 | -10.41 | -150.3 |
| 9.1 | -18.19 | 59.3 | 21.71 | 132.2 | -57.49 | 93.9 | -9.98 | -160.1 |
| 9.2 | -19.31 | 45.4 | 21.63 | 116.7 | -57.13 | 77.9 | -9.83 | -170.4 |
| 9.3 | -20.44 | 29.9 | 21.49 | 101.3 | -57.62 | 59.4 | -9.84 | 179.4 |
| 9.4 | -21.28 | 14.1 | 21.30 | 86.3 | -57.57 | 40.5 | -10.03 | 168.5 |
| 9.5 | -21.77 | -3.6 | 21.07 | 71.4 | -57.59 | 20.7 | -10.44 | 158.1 |
| 9.6 | -21.75 | -19.6 | 20.81 | 56.8 | -57.61 | 3.4 | -10.91 | 147.1 |
| 9.7 | -21.45 | -35.6 | 20.52 | 42.5 | -57.36 | -15.4 | -11.62 | 136.0 |
| 9.8 | -20.72 | -48.2 | 20.24 | 28.3 | -57.08 | -32.3 | -12.32 | 124.6 |
| 9.9 | -19.95 | -58.9 | 19.95 | 14.3 | -56.69 | -51.1 | -13.23 | 112.1 |
| 10.0 | -19.15 | -68.3 | 19.67 | 0.4 | -56.18 | -64.5 | -14.16 | 100.1 |
| 10.1 | -18.33 | -76.7 | 19.38 | -13.4 | -55.71 | -80.0 | -15.11 | 86.9 |
| 10.2 | -17.51 | -84.1 | 19.11 | -27.2 | -54.67 | -92.3 | -16.20 | 73.2 |
| 10.3 | -16.67 | -91.4 | 18.86 | -41.1 | -54.34 | -106.2 | -17.11 | 59.2 |
| 10.4 | -15.95 | -98.1 | 18.61 | -55.0 | -53.49 | -119.4 | -18.22 | 43.6 |
| 10.5 | -15.23 | -104.5 | 18.37 | -69.0 | -53.00 | -133.6 | -19.22 | 28.4 |
| 10.6 | -14.62 | -110.8 | 18.13 | -83.0 | -52.35 | -144.6 | -20.24 | 11.4 |
| 10.7 | -13.99 | -117.4 | 17.89 | -97.2 | -51.80 | -155.4 | -21.37 | -7.1 |
| 10.8 | -13.41 | -123.9 | 17.65 | -111.8 | -51.56 | -166.5 | -22.33 | -26.6 |
| 10.9 | -12.87 | -130.8 | 17.42 | -126.3 | -51.12 | -178.6 | -23.12 | -50.8 |
| 11.0 | -12.39 | -137.8 | 17.17 | -141.0 | -50.77 | 170.8 | -23.74 | -75.6 |
| 11.1 | -11.97 | -145.6 | 16.93 | -156.2 | -50.69 | 159.1 | -23.25 | -104.2 |
| 11.2 | -11.57 | -153.5 | 16.64 | -171.4 | -50.33 | 147.9 | -22.17 | -131.1 |
| 11.3 | -11.21 | -162.1 | 16.34 | 173.1 | -50.57 | 136.5 | -20.63 | -153.4 |
| 11.4 | -10.91 | -171.2 | 16.00 | 157.3 | -50.76 | 124.9 | -18.89 | -174.0 |
| 11.5 | -10.63 | 179.2 | 15.63 | 141.4 | -50.93 | 112.2 | -17.29 | 168.8 |

**$T_A$ = 25°C, $V_D$= +8 V , $I_D$= 1.1 A**

Reference planes for S-parameter data include bond wires as specified in the "Recom mended Assembly Diagram."

## RF CHARACTERISTICS

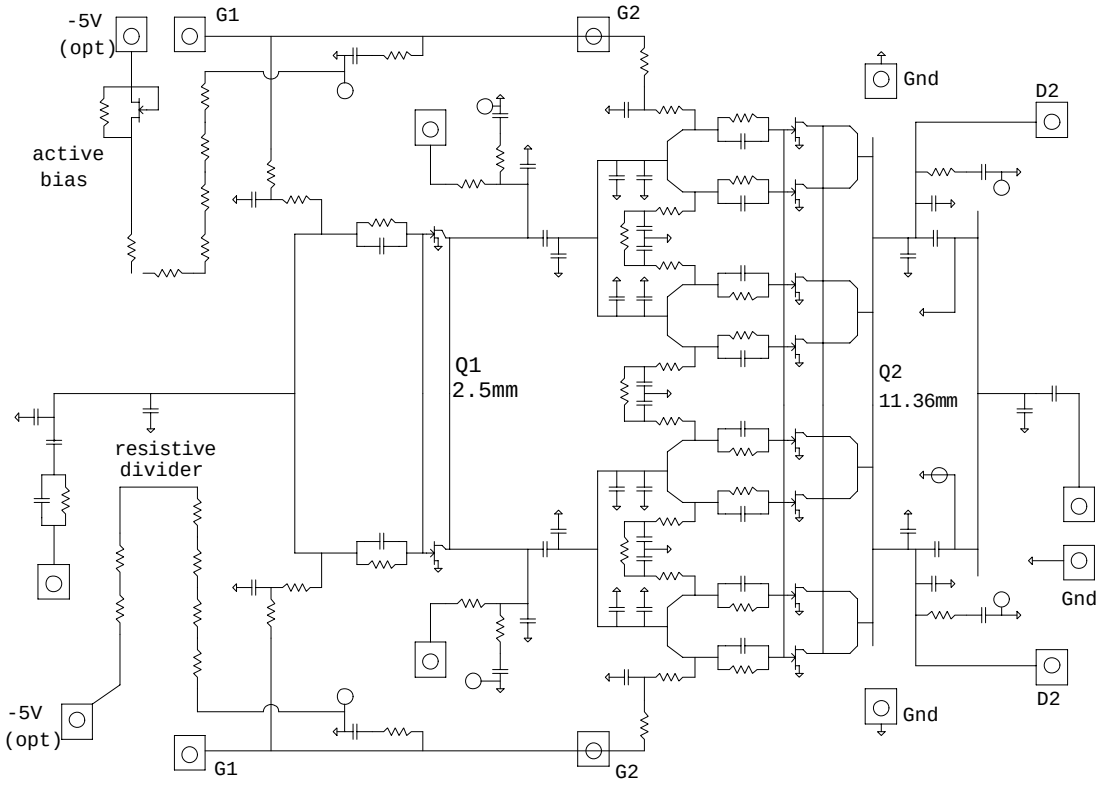
| PARAMETER | | TEST CONDITIONS | TYP | UNIT |
|---|---|---|---|---|
| GP | Small Signal Power Gain | 6.5 to 11.5 GHz | 9 | dB |
| IRL | Input Return Loss | 6.5 to 11.5 GHz | 12 | dB |
| ORL | Output Return Loss | 6.5 to 11.5 GHz | 9 | dB |
| PAE | Power Added Efficiency | 6.5 to 11.5 GHz | 40 | % |
| $P_{2dB}$ | Output Power at 2-dB Gain Compression | 6.5 to 11.5 GHz | 37 | dBm |
| $IP_3$ | Output Third-order Intercept Point | 6.5 to 11.5 GHz | 44 | dBm |

**$V_D$ =+7 V, $I_D$=1.5 A, $T_A$ = 25 °C unless stated**

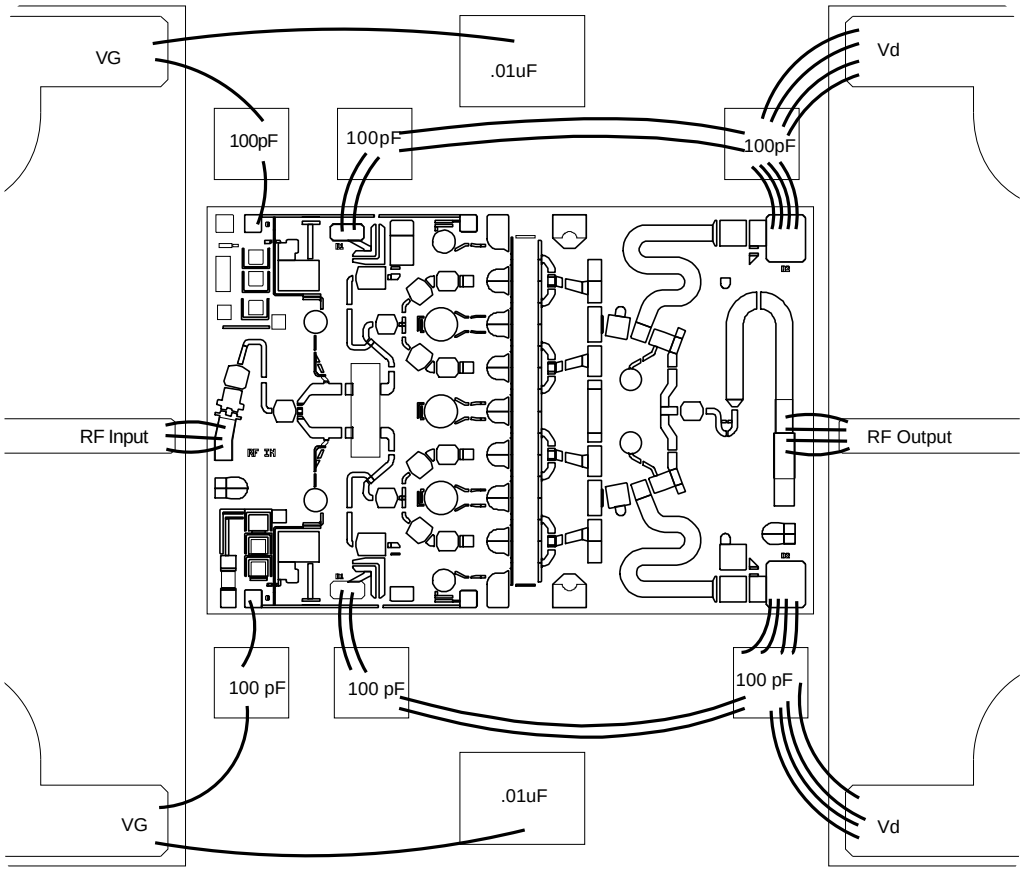
## THERMAL INFORMATION

| PARAMETER | | TEST CONDITIONS | NOM | UNIT |
|---|---|---|---|---|
| $R_{JC}$ | Thermal resistance, channel to backside | 25°C Base, $V_D$=9 V, $I_D$=1.2 A, $P_D$=6 W | 10 | °C/W |

## EQUIVALENT SCHEMATIC



**RECOMMENDED ASSEMBLY DIAGRAM**

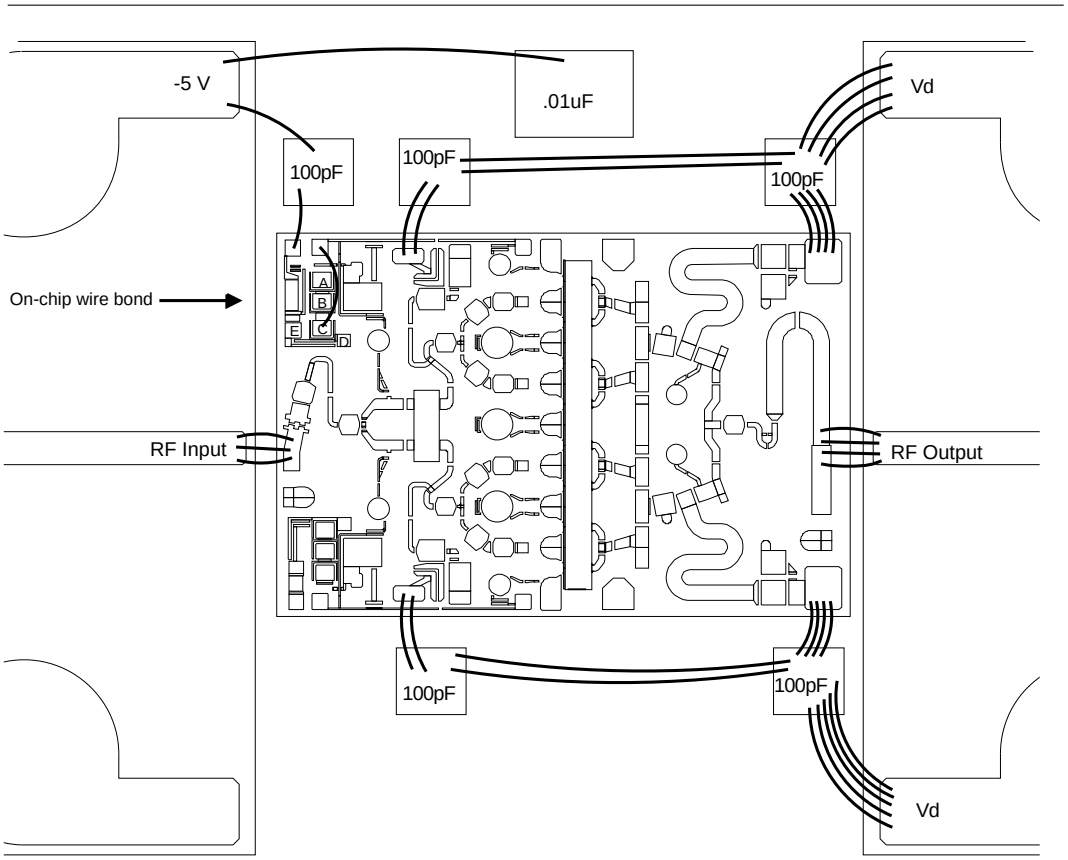



Bond using three (four at $RF_{OUT}$) 1.0-mil diameter, 25 to 30-mil length gold bond wires at RF Input and RF Output for optimum performance. Bond wires connected to the RF Output pad should be equal distance from center line as indicated in drawing. Close placement of external components is essential to stability.

Gate bias ( $V_G$ ) voltage can be applied from either side of MMIC.

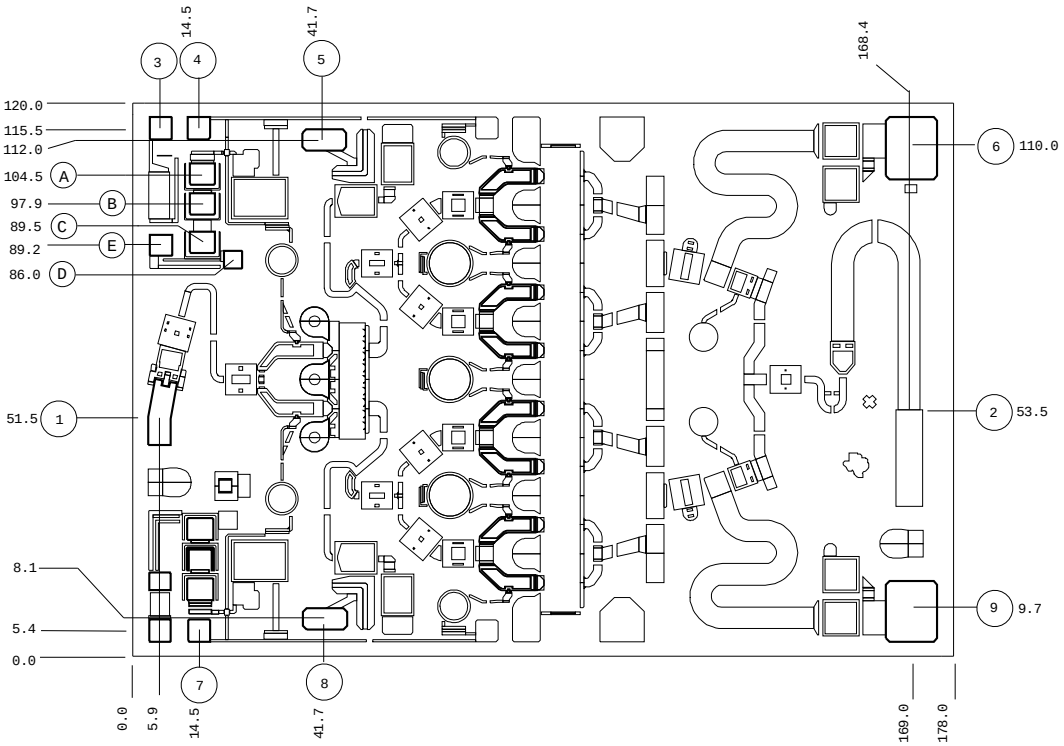
Drain bias ( $V_D$) voltage should be connected to both sides of MMIC.

**RECOMMENDED ASSEMBLY DIAGRAM USING ACTIVE GATE BIAS CIRCUIT**




Bond using three (four at $RF_{OUT}$) 1.0-mil diameter, 25 to 30-mil length gold bond wires at RF Input and RF Output for optimum performance. Bond wires connected to the RF Output pad should be equal distance from center line as indicated in drawing. Close placement of external components is essential to stability.
Drain bias ( $V_D$) voltage should be connected to both sides of MMIC.

## MECHANICAL DRAWING




Units: millimeters (inches)
Thickness: 0,1016 (0.004) (reference only)
Chip edge to bond pad dimensions are shown to center of bond pad.
Chip size +/- 0,0508 (0.002)

| | | |
|---|---|---|
| Bond pad #1 | (RF Input) | Center two bond wires equal distance from center line |
| Bond pad #2 | (RF Output) | Center two bond wires equal distance from center line |
| Bond pad #3 | ($-V_{AGB}$ ) | 0,120 x 0,120 (.0047 x .0047) |
| Bond pad #4, #7 | ($-V_G$) | 0,120 x 0,120 (.0047 x .0047) |
| Bond pad #5, #8 | ($V_{D1}$) | 0,240 x 0,120 (.0094 x .0047) |
| Bond pad #6, #9 | ($V_{D2}$) | 0,275 x 0,340 (.0108 x .0134) |
| Bond pads A,B,C,D,E | | 0,120 x 0,120 (.0047 x .0047) |