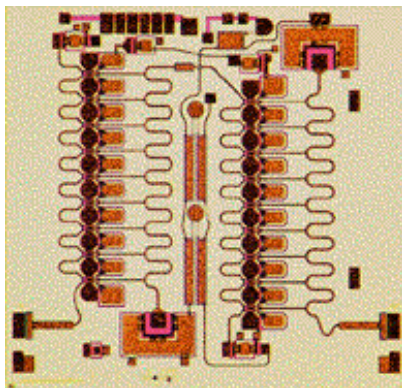


**2 - 18 GHz Low Noise Amplifier****TGA8344-SCC****Key Features and Performance**

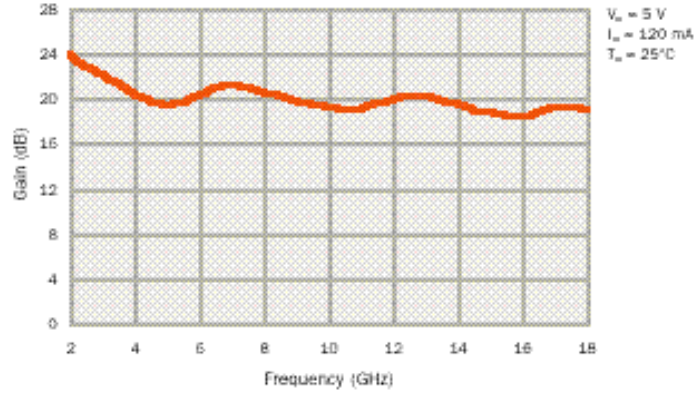
- 2 to 18 GHz Frequency Range
- Typical 4 dB Noise Figure at Midband
- 16 dBm Typical Output Power at 1 dB Gain Compression
- 19 dB Typical Gain
- Typical Input SWR 1.5:1 and Output SWR 1.6:1
- 3.9878 x 3.810 x 0.1016 mm (0.1570 x 0.150 x 0.0040 in.)

**Description**

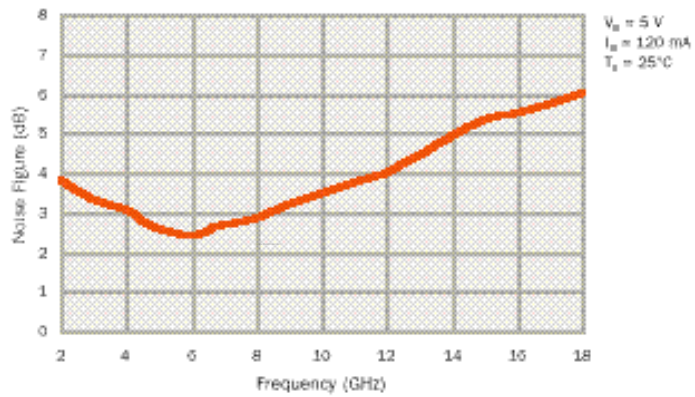
The TriQuint TGA8344-SCC features two cascaded monolithic low-noise distributed amplifiers with on-chip bias operating from 2 to 18 GHz. This die offers the advantage of high gain, typically 19 dB, in compact die size with simplified biasing configuration. Noise figure is typically 4 dB. The two cascade amplifiers have eighteen 122 um gatewidth FETs providing 16 dBm of output power at 1 dB gain compression. Input return loss is typically 14 dB from 2 to 18 GHz and output return loss is typically 13 dB. Ground is provided to the circuitry through vias to the backside metallization. The TGA8344-SCC small size and high gain make it suitable for use in a variety of wide-band electronic commercial and warfare systems.

Bond pad and backside metallization is gold plated for compatibility with eutectic alloy attachment methods as well as the thermocompression wire-bonding processes. The TGA8344-SCC is supplied in chip form and is readily assembled using automated equipment.

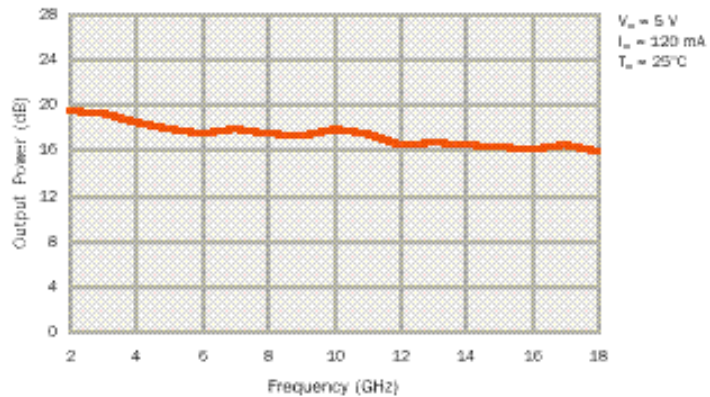
**TYPICAL  
SMALL-SIGNAL  
POWER GAIN**



**TYPICAL  
NOISE FIGURE**



**TYPICAL  
OUTPUT POWER  
 $P_{1dB}$**



**TYPICAL  
RETURN LOSS**

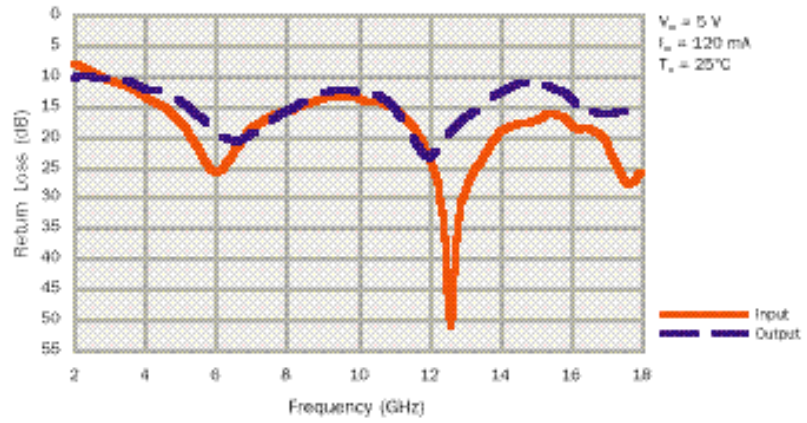


TABLE I  
 MAXIMUM RATINGS

| SYMBOL           | PARAMETER   | VALUE         |
|------------------|---|---------------|
| $V_D$            | DRAIN SUPPLY VOLTAGE  | 9V            |
| $V^+$            | POSITIVE SUPPLY VOLTAGE   | 12V           |
| $V^+ - V^-$      | POSITIVE SUPPLY VOLTAGE RANGE WITH RESPECT TO NEGATIVE SUPPLY VOLTAGE | 0V to 13V     |
| $V_{CTRL} - V^+$ | POSITIVE SUPPLY VOLTAGE WITH RESPECT TO GAIN CONTROL VOLTAGE          | 0V to -13V    |
| $V^-$            | NEGATIVE SUPPLY VOLTAGE RANGE   | -5V to 0V     |
| $V_{CTRL}$       | GAIN CONTROL VOLTAGE RANGE  | -5V to 4V     |
| $I^+$            | POSITIVE SUPPLY CURRENT   | 376mA         |
| $I^-$            | NEGATIVE SUPPLY CURRENT   | -8.73mA       |
| $P_D$            | POWER DISSIPATION, AT (OR BELOW) 25°C BASE-PLATE TEMPERATURE *        | 5.3W          |
| $P_{IN}$         | INPUT CONTINUOUS WAVE POWER   | 23dBm         |
| $T_{CH}$ **      | OPERATING CHANNEL TEMPERATURE   | 150 °C        |
| $T_M$            | MOUNTING TEMPERATURE (30 SECONDS)                                     | 320 °C        |
| $T_{STG}$        | STORAGE TEMPERATURE   | -65 to 150 °C |

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

Stresses beyond those listed under “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 Specifications” is not implied. Exposure to maximum rated conditions for extended periods may affect device reliability.

\*For operation above 25°C base-plate temperature, derate linearly at the rate of 11.2mW/°C.

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

TABLE II  
DC PROBE TESTS (100%)  
(T<sub>A</sub> = 25 °C Nominal)

| NOTES        | SYMBOL                 | TEST CONDITIONS <u>3/</u> | LIMITS |     | UNITS |
|--------------|------------------------|---------------------------|--------|-----|-------|
|              |                        |                           | MIN    | MAX |       |
| <u>2/</u>    | I <sub>DSS1-9</sub>    | STD                       | 110    | 307 | mA    |
| <u>2/</u>    | G <sub>M1-9</sub>      | STD                       | 186    | 340 | mS    |
| <u>1/,2/</u> | V <sub>BVGS1-9</sub>   | STD                       | 6      | 30  | V     |
| <u>1/,2/</u> | V <sub>P1-9, 1</sub>   | STD                       | 0.5    | 1.8 | V     |
| <u>1/,2/</u> | V <sub>P1-9, 2</sub>   | STD                       | 0.5    | 1.8 | V     |
| <u>1/,2/</u> | V <sub>P10-18, 1</sub> | STD                       | 0.5    | 1.8 | V     |
| <u>1/,2/</u> | V <sub>P10-18, 2</sub> | STD                       | 0.5    | 1.8 | V     |

- 1/ V<sub>BVGS1-9</sub>, V<sub>P1-9</sub>, and V<sub>P10-18</sub> are negative
- 2/ Subscripts are referred to Q1 through Q18 accordingly.
- 3/ The measurement conditions are subject to change at the manufacturer's discretion (with appropriate notification to the buyer).

STD – Standard Test Conditions (see Table IV for definitions)

TABLE III  
RF CHARACTERISTICS  
(T<sub>A</sub> = 25°C Nominal)

| NOTE      | TEST  | MEASUREMENT<br>CONDITIONS<br>V <sub>D</sub> = 8V, I <sup>+</sup> = 120 ± 5% mA <sup>1/</sup> | VALUE |      | UNITS |
|-----------|---|--|-------|------|-------|
|           |   |  | MIN   | MAX  |       |
| <u>2/</u> | SMALL-SIGNAL<br>GAIN MAGNITUDE              | 2 – 18 GHz   | 14    |      | dB    |
| <u>2/</u> | POWER OUTPUT<br>AT 1 dB GAIN<br>COMPRESSION | 2 – 16 GHz   | 13    |      | dBm   |
|           |   | 18 GHz   | 12    |      | dBm   |
| <u>2/</u> | INPUT RETURN<br>LOSS MAGNITUDE              | 2 – 18 GHz   |       | -7.7 | dB    |
| <u>2/</u> | OUTPUT RETURN<br>LOSS MAGNITUDE             | 2 – 18 GHz   |       | -7.7 | dB    |
| <u>2/</u> | NOISE FIGURE                                | 2 – 14 GHz   |       | 5.7  | dB    |
|           |   | 16 – 18 GHz  |       | 7    | dB    |

1/ V<sub>G2</sub> (approximately 1.5V) is provided through an on chip voltage divider.

2/ RF probe data is taken at 2 GHz steps

Table IV  
AUTOPROBE FET PARAMETER MEASUREMENT CONDITIONS

| FET Parameters  | Test Conditions  |
|---|--|
| <b>I<sub>DSS</sub></b> : Maximum drain current (I <sub>DS</sub> ) with gate voltage (V <sub>GS</sub> ) at zero volts.                       | V <sub>GS</sub> = 0.0 V, drain voltage (V <sub>DS</sub> ) is swept from 0.5 V up to a maximum of 3.5 V in search of the maximum value of I <sub>DS</sub> ; voltage for I <sub>DSS</sub> is recorded as VDSP.   |
| <b>G<sub>m</sub></b> : Transconductance; $\frac{(I_{DSS} - IDS1)}{VG1}$   | For all material types, V <sub>DS</sub> is swept between 0.5 V and VDSP in search of the maximum value of I <sub>ds</sub> . This maximum I <sub>DS</sub> is recorded as IDS1. For Intermediate and Power material, IDS1 is measured at V <sub>GS</sub> = VG1 = -0.5 V. For Low Noise, HFET and pHEMT material, V <sub>GS</sub> = VG1 = -0.25 V. For LNBECOLC, use V <sub>GS</sub> = VG1 = -0.10 V. |
| <b>V<sub>P</sub></b> : Pinch-Off Voltage; V <sub>GS</sub> for I <sub>DS</sub> = 0.5 mA/mm of gate width.                                    | V <sub>DS</sub> fixed at 2.0 V, V <sub>GS</sub> is swept to bring I <sub>DS</sub> to 0.5 mA/mm.  |
| <b>V<sub>BVGD</sub></b> : Breakdown Voltage, Gate-to-Drain; gate-to-drain breakdown current (I <sub>BD</sub> ) = 1.0 mA/mm of gate width.   | Drain fixed at ground, source not connected (floating), 1.0 mA/mm forced into gate, gate-to-drain voltage (V <sub>GD</sub> ) measured is V <sub>BVGD</sub> and recorded as BVGD; this cannot be measured if there are other DC connections between gate-drain, gate-source or drain-source.  |
| <b>V<sub>BVGS</sub></b> : Breakdown Voltage, Gate-to-Source; gate-to-source breakdown current (I <sub>BS</sub> ) = 1.0 mA/mm of gate width. | Source fixed at ground, drain not connected (floating), 1.0 mA/mm forced into gate, gate-to-source voltage (V <sub>GS</sub> ) measured is V <sub>BVGS</sub> and recorded as BVGS; this cannot be measured if there are other DC connections between gate-drain, gate-source or drain-source.   |

**TYPICAL S-PARAMETERS**

| Frequency<br>(GHz) | S <sub>11</sub> |        | S <sub>21</sub> |        | S <sub>12</sub> |        | S <sub>22</sub> |        | GAIN<br>(dB) |
|--------------------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|--------------|
|                    | MAG             | ANG(°) | MAG             | ANG(°) | MAG             | ANG(°) | MAG             | ANG(°) |              |
| 1.0                | 0.63            | -79    | 22.70           | 38     | 0.000           | 155    | 0.32            | 118    | 27.1         |
| 1.4                | 0.52            | -103   | 20.49           | -46    | 0.000           | -153   | 0.27            | 24     | 26.2         |
| 1.8                | 0.43            | -123   | 16.92           | -95    | 0.001           | 157    | 0.30            | -24    | 24.6         |
| 2.2                | 0.37            | -140   | 15.01           | -133   | 0.001           | 134    | 0.31            | -57    | 23.5         |
| 2.6                | 0.33            | -158   | 13.76           | -167   | 0.001           | 114    | 0.31            | -85    | 22.8         |
| 3.0                | 0.29            | -175   | 12.85           | 161    | 0.001           | 111    | 0.30            | -110   | 22.2         |
| 3.4                | 0.26            | 167    | 12.00           | 130    | 0.001           | 105    | 0.28            | -135   | 21.6         |
| 3.8                | 0.23            | 147    | 11.03           | 100    | 0.001           | 109    | 0.26            | -160   | 20.8         |
| 4.2                | 0.20            | 130    | 10.32           | 73     | 0.002           | 90     | 0.24            | -180   | 20.3         |
| 4.6                | 0.17            | 109    | 9.68            | 47     | 0.001           | 59     | 0.22            | 151    | 19.7         |
| 5.0                | 0.13            | 86     | 9.45            | 23     | 0.001           | 71     | 0.19            | 124    | 19.5         |
| 5.4                | 0.09            | 57     | 9.69            | -2     | 0.001           | 115    | 0.16            | 94     | 19.7         |
| 5.8                | 0.06            | 11     | 10.25           | -28    | 0.001           | 149    | 0.12            | 58     | 20.2         |
| 6.2                | 0.05            | -59    | 10.89           | -57    | 0.001           | 159    | 0.10            | 15     | 20.7         |
| 6.6                | 0.08            | -109   | 11.36           | -88    | 0.002           | 155    | 0.09            | -38    | 21.1         |
| 7.0                | 0.11            | -139   | 11.51           | -119   | 0.003           | 141    | 0.10            | -83    | 21.2         |
| 7.4                | 0.14            | -162   | 11.36           | -150   | 0.003           | 131    | 0.13            | -115   | 21.1         |
| 7.8                | 0.16            | 179    | 10.94           | 180    | 0.003           | 112    | 0.15            | -140   | 20.8         |
| 8.2                | 0.16            | 166    | 10.56           | 151    | 0.004           | 103    | 0.17            | -159   | 20.5         |
| 8.6                | 0.18            | 155    | 10.29           | 122    | 0.003           | 89     | 0.20            | -176   | 20.2         |
| 9.0                | 0.20            | 140    | 9.94            | 93     | 0.002           | 74     | 0.23            | 165    | 20.0         |
| 9.4                | 0.21            | 123    | 9.55            | 66     | 0.001           | 84     | 0.24            | 145    | 19.6         |
| 9.8                | 0.21            | 107    | 9.34            | -38    | 0.001           | 109    | 0.24            | 126    | 19.4         |
| 10.2               | 0.20            | 92     | 9.19            | 11     | 0.001           | 155    | 0.23            | 105    | 19.3         |
| 10.6               | 0.19            | 74     | 9.00            | -16    | 0.001           | 153    | 0.21            | 83     | 19.1         |
| 11.0               | 0.17            | 56     | 9.16            | -42    | 0.002           | -174   | 0.17            | 56     | 19.2         |
| 11.4               | 0.13            | 38     | 9.53            | -70    | 0.003           | -178   | 0.12            | 22     | 19.6         |
| 11.8               | 0.09            | 18     | 9.84            | -99    | 0.004           | 166    | 0.07            | -25    | 19.9         |
| 12.2               | 0.05            | -8     | 10.28           | -130   | 0.004           | 155    | 0.08            | -92    | 20.2         |
| 12.6               | 0.00            | -131   | 10.41           | -162   | 0.004           | 143    | 0.11            | -140   | 20.3         |
| 13.0               | 0.03            | 143    | 10.38           | 166    | 0.004           | 127    | 0.14            | -165   | 20.3         |
| 13.4               | 0.06            | 132    | 10.15           | 134    | 0.003           | 119    | 0.17            | 176    | 20.1         |
| 13.8               | 0.09            | 126    | 9.72            | 102    | 0.002           | 97     | 0.21            | 160    | 19.7         |
| 14.2               | 0.12            | 104    | 9.35            | 72     | 0.001           | 78     | 0.25            | 140    | 19.4         |
| 14.6               | 0.13            | 91     | 8.86            | 42     | 0.000           | -93    | 0.27            | 117    | 18.9         |
| 15.0               | 0.14            | 80     | 8.69            | 13     | 0.001           | -96    | 0.27            | 93     | 18.8         |
| 15.4               | 0.15            | 65     | 8.54            | -17    | 0.002           | -94    | 0.25            | 65     | 18.6         |
| 15.8               | 0.14            | 43     | 8.44            | -47    | 0.004           | -90    | 0.23            | 32     | 18.5         |
| 16.2               | 0.11            | 32     | 8.45            | -76    | 0.008           | -120   | 0.18            | -6     | 18.5         |
| 16.6               | 0.11            | 11     | 9.00            | -107   | 0.009           | -153   | 0.16            | -50    | 19.1         |
| 17.0               | 0.09            | -28    | 9.26            | -142   | 0.008           | -179   | 0.16            | -101   | 19.3         |
| 17.4               | 0.05            | -84    | 9.25            | -176   | 0.008           | 159    | 0.16            | -144   | 19.3         |

$$V_D = 5 \text{ V}, I_D = 120 \text{ mA}, T_A = 25^\circ\text{C}$$

The reference planes for S-parameter data include bond wires as specified in the "Recommended Assembly Diagram." The S-parameters are also available on floppy disk and the world wide web.



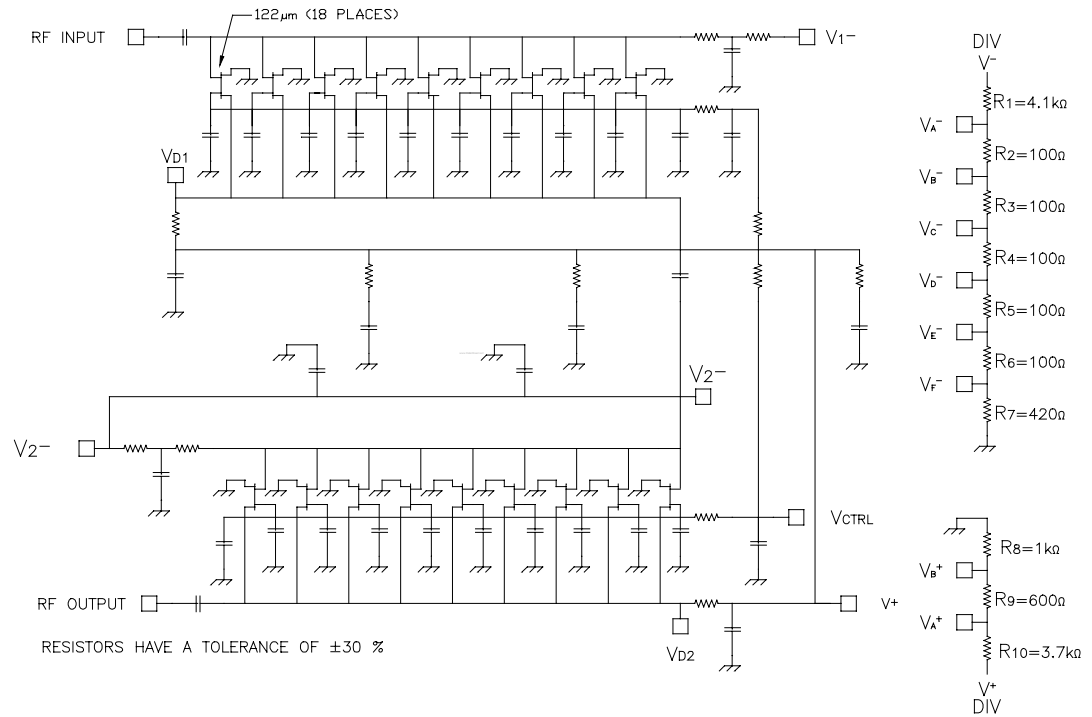
**THERMAL DATA**

| PARAMETER       |   | TEST CONDITIONS   | FET | MMIC | UNIT |
|-----------------|---|---|-----|------|------|
| $R_{\theta JC}$ | Thermal resistance, channel-to-backside | 25°C Base, 31.83°C Channel†, $I_D = 0.12$ A, $V = 5$ , $P_D = 0.6$ W**  | 205 | 11.4 | °C/W |
| $R_{\theta JC}$ | Thermal resistance, channel-to-backside | 100°C Base, 108.6°C Channel†, $I_D = 0.12$ A, $V = 5$ , $P_D = 0.6$ W** | 258 | 14.4 | °C/W |

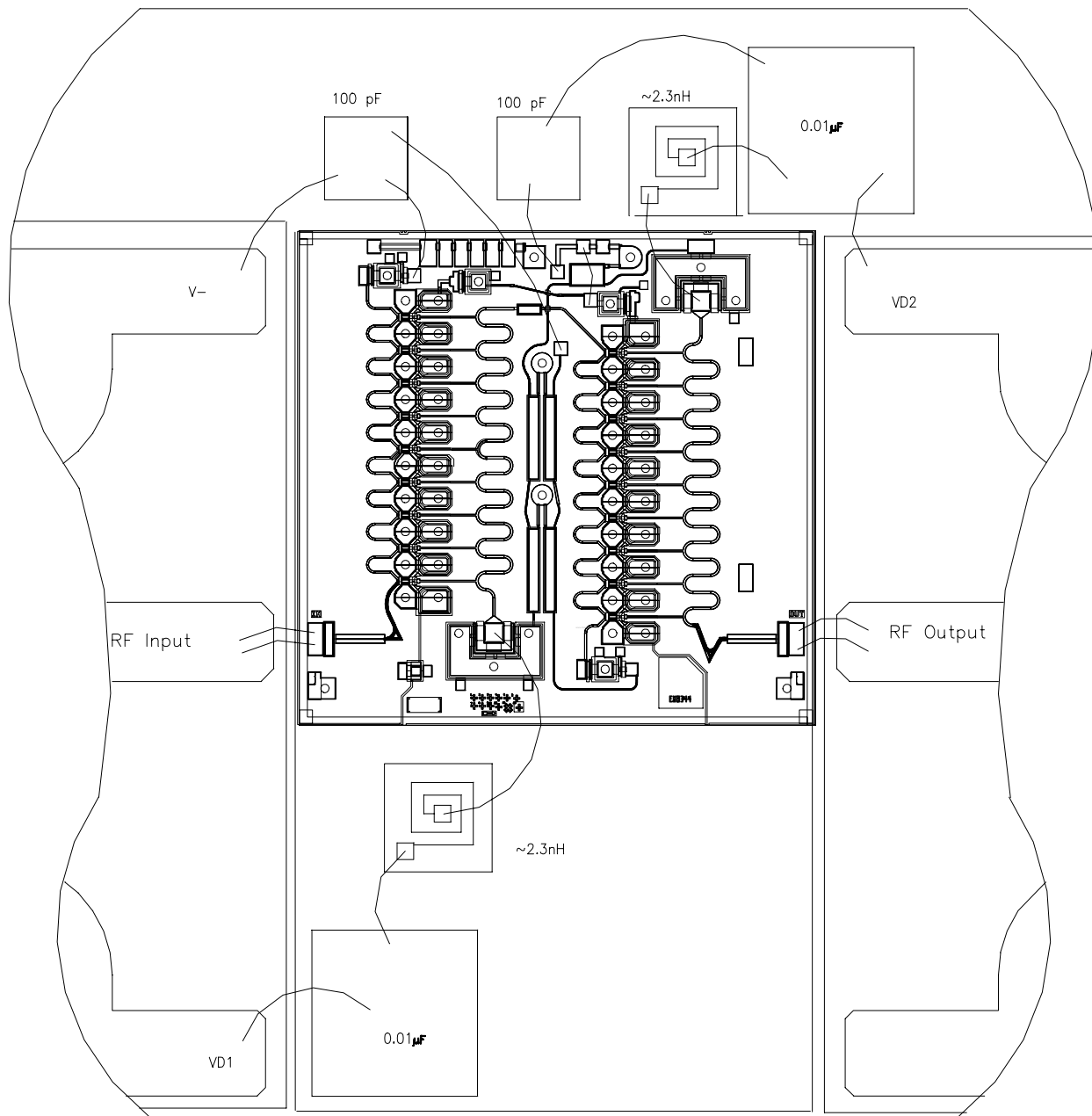
\* Center of FET of either TGA8344 half-amplifier.

\*\* Total power dissipation for TGA8344: divide by 18 to obtain the single-FET power dissipation.

**EQUIVALENT SCHEMATIC**



**RECOMMENDED  
ASSEMBLY  
DIAGRAM**



RF connections: Bond using two 1.0-mil diameter, 20 to 30-mil-length gold bond wires at both RF Input and RF Output for optimum RF performance.

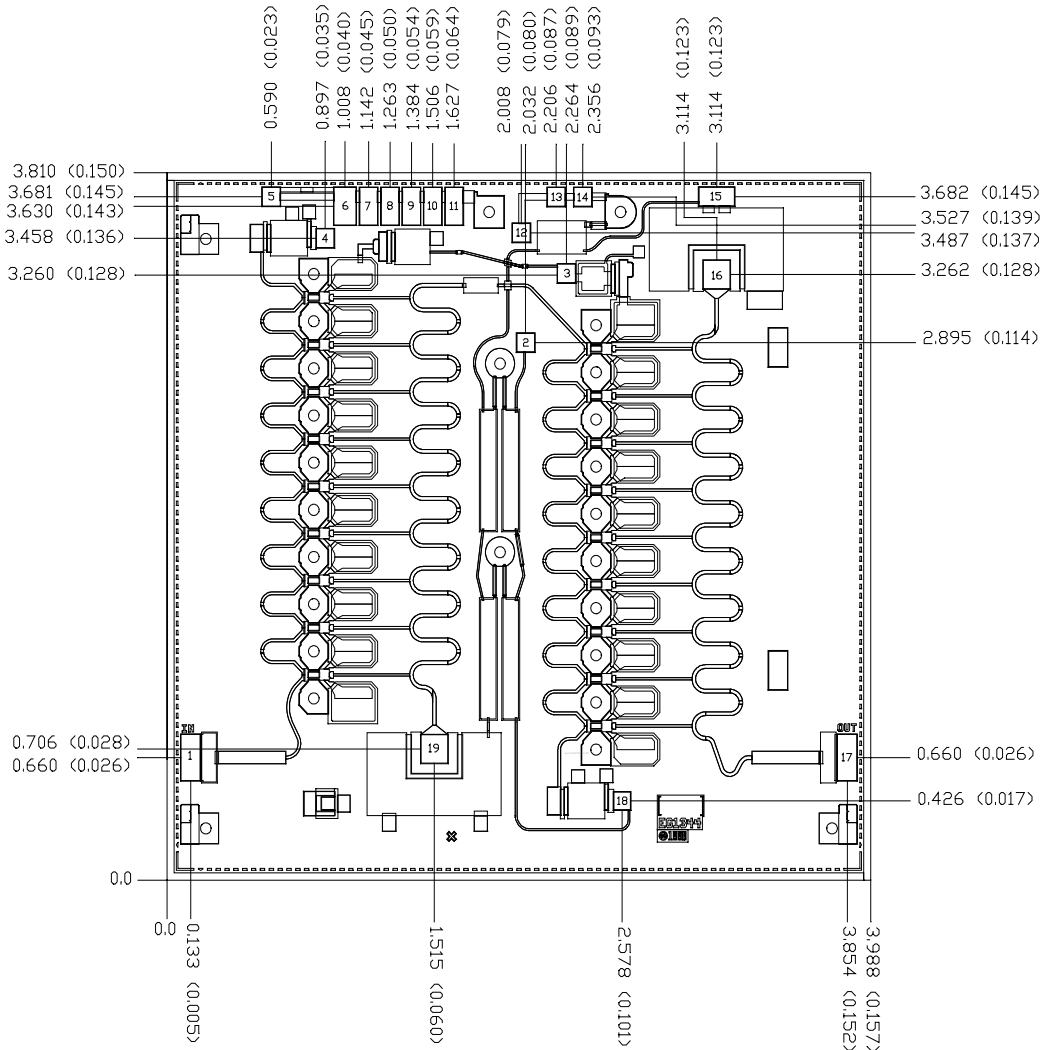
$V_- = V_{1-} = V_{2-}$

Two on-chip to on-chip wire bonds are needed for bond pads 3 and 13.

Close placement of external components is essential to stability.

Refer to TriQuint's Gallium Arsenide Products Designers' Information on our website under Application Information.

**MECHANICAL  
DRAWING**



Units: millimeters (inches)

Thickness: 0.1016 (0.004)

Chip edge to bond pad dimensions are shown to center of bond pad

Chip size tolerance: +/- 0.051 (0.002)

|                        |                               |                          |                                 |
|------------------------|-------------------------------|--------------------------|---------------------------------|
| Bond Pad #1 (RF Input) | 0.109 x 0.249 (0.004 x 0.010) | Bond Pad #11 (VF-)       | 0.102 x 0.203 (0.004 x 0.008)   |
| Bond Pad #2 (V2-)      | 0.102 x 0.102 (0.004 x 0.004) | Bond Pad #12 (Vdiv+)     | 0.102 x 0.102 (0.004 x 0.004)   |
| Bond Pad #3 (Vctrl)    | 0.102 x 0.102 (0.004 x 0.004) | Bond Pad #13 (VA+)       | 0.102 x 0.102 (0.004 x 0.004)   |
| Bond Pad #4 (V1-)      | 0.102 x 0.102 (0.004 x 0.004) | Bond Pad #14 (VB+)       | 0.102 x 0.102 (0.004 x 0.004)   |
| Bond Pad #5 (Vdiv-)    | 0.102 x 0.102 (0.004 x 0.004) | Bond Pad #15 (V+)        | 0.102 x 0.203 (0.004 x 0.008)   |
| Bond Pad #6 (VA-)      | 0.127 x 0.203 (0.005 x 0.008) | Bond Pad #16 (VD2)       | 0.157 x 0.158 (0.006 x 0.006)   |
| Bond Pad #7 (VB-)      | 0.102 x 0.203 (0.004 x 0.008) | Bond Pad #17 (RF Output) | 0.109 x 0.249 (0.004 x 0.010)   |
| Bond Pad #8 (VC-)      | 0.102 x 0.203 (0.004 x 0.008) | Bond Pad #18 (V2-)       | 0.097 x 0.097 (0.0003 x 0.0003) |
| Bond Pad #9 (VD-)      | 0.102 x 0.203 (0.004 x 0.008) | Bond Pad #19 (VD1)       | 0.157 x 0.158 (0.006 x 0.006)   |
| Bond Pad #10 (VE-)     | 0.102 x 0.203 (0.004 x 0.008) |                          |                                 |

**GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.**