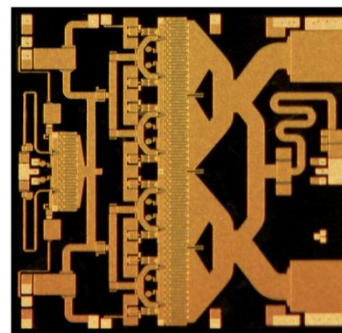


### Applications

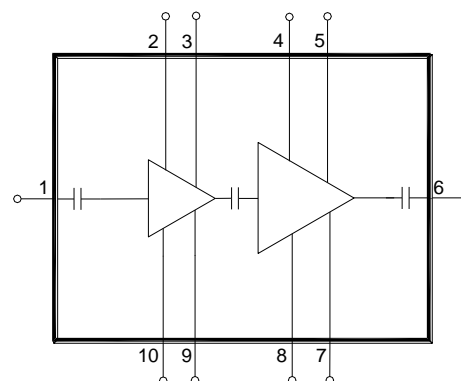
- Radar



### Product Features

- Frequency Range: 3.1 – 3.6 GHz
- $P_{SAT}$ : 49.5 dBm
- Power Gain > 22 dB Large Signal Gain
- PAE: 56%
- Bias:  $V_D = 30$  V,  $I_{DQ} = 125$  mA,  $V_G = -2.95$  V Typical
- Characterized at PW = 15ms and DC = 30%
- Chip Dimensions: 5.41 x 5.19 x 0.10 mm

### Functional Block Diagram



### General Description

TriQuint's TGA2814 is a high-power, s-band amplifier fabricated on TriQuint's production 0.25um GaN on SiC process (TQGaN25). Covering 3.1-3.6GHz, the TGA2814 provides 80W of saturated output power and 22dB of large-signal gain while achieving 56% power-added efficiency.

The TGA2814 can also support a variety of operating conditions to best support system requirements. With good thermal properties, it can support a range of bias voltages and will perform well under both short and long pulse operations.

With DC blocking capacitors on both RF ports which are matched to 50ohms, the TGA2814 is ideal for both commercial and military radar systems.

Lead-free and RoHS compliant.

### Pad Configuration

Pad No.	Symbol
1	RF In
2, 4, 8, 10	$V_G$
3, 5, 7, 9	$V_D$
6	RF Out

### Ordering Information

Part	ECCN	Description
TGA2814	3A001.b.2.a	3.1 – 3.6 GHz 80W GaN Power Amplifier

### Absolute Maximum Ratings

Parameter	Value
Drain Voltage ( $V_D$ )	40 V
Gate Voltage Range ( $V_G$ )	-8 to 0 V
Drain Current ( $I_D$ )	8.5 A
Gate Current ( $I_G$ )	-6 to 42 mA
Power Dissipation ( $P_{DISS}$ )	166 W
Input Power, CW, 50 $\Omega$ , 85 °C, ( $P_{IN}$ )	30 dBm
Input Power, VSWR 3:1, $V_D = 30V$ , PW = 15ms, DC = 30%, 85 °C, ( $P_{IN}$ )	27 dBm
Channel Temperature ( $T_{CH}$ )	275 °C
Mounting Temperature (30 Seconds)	320 °C
Storage Temperature	-55 to 150 °C

Operation of this device outside the parameter ranges given above may cause permanent damage. These are stress ratings only, and functional operation of the device at these conditions is not implied.

### Recommended Operating Conditions

Parameter	Value
Drain Voltage ( $V_D$ )	30 V
Drain Current ( $I_{DQ}$ )	125 mA
Drain Current Under RF Drive ( $I_{D\_Drive}$ )	5000 mA
Gate Voltage ( $V_G$ )	-2.95 V (Typ.)

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

### Electrical Specifications

Test conditions unless otherwise noted: 25 °C,  $V_D = 30 V$ ,  $I_{DQ} = 125 mA$ ,  $V_G = -2.95 V$  Typical, Pulsed: PW = 15ms, DC = 30%

Parameter	Min	Typical	Max	Units
Operational Frequency Range	3.1		3.6	GHz
Input Return Loss		-10		dB
Output Return Loss		-7		dB
Power Gain @ Saturation ( $P_{in} = 27dBm$ )		>22		dB
Output Power @ Saturation ( $P_{in} = 27dBm$ )		49.5		dBm
Power Added Efficiency ( $P_{in} = 27dBm$ )		56		%
Output Power Temperature Coefficient		-0.002		dBm/°C

### Thermal and Reliability Information

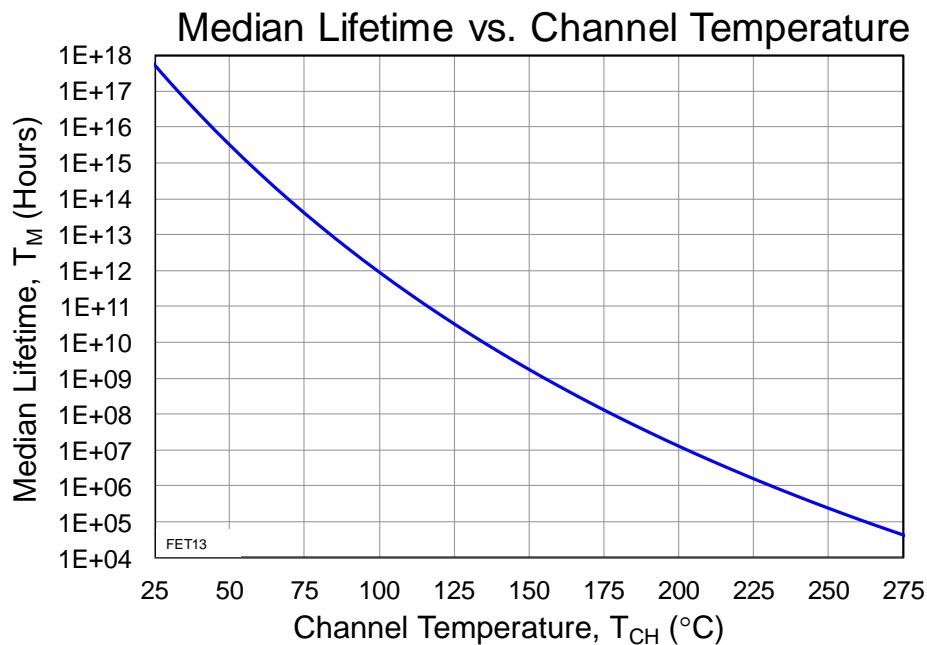
Parameter	Test Conditions	Value	Units
Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>	$T_{base} = 85\text{ }^{\circ}\text{C}$ , $V_D = 30\text{ V}$ , $I_{D\_Drive} = 5\text{ A}$ , $P_{out} = 49.5\text{ dBm}$ , $P_{DISS} = 59\text{ W}$ , Pulsed: $PW = 15\text{ms}$ , $DC = 30\%$	1.14	$^{\circ}\text{C/W}$
Channel Temperature ( $T_{CH}$ )		152	$^{\circ}\text{C}$
Median Lifetime ( $T_M$ )		$1.41 \times 10^9$	Hrs
Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>	$T_{base} = 85\text{ }^{\circ}\text{C}$ , $V_D = 32\text{ V}$ , $I_{D\_Drive} = 5.3\text{ A}$ , $P_{out} = 50.0\text{ dBm}$ , $P_{DISS} = 59\text{ W}$ , Pulsed: $PW = 15\text{ms}$ , $DC = 30\%$	1.2	$^{\circ}\text{C/W}$
Channel Temperature ( $T_{CH}$ )		156	$^{\circ}\text{C}$
Median Lifetime ( $T_M$ )		$9.14 \times 10^8$	Hrs

Notes:

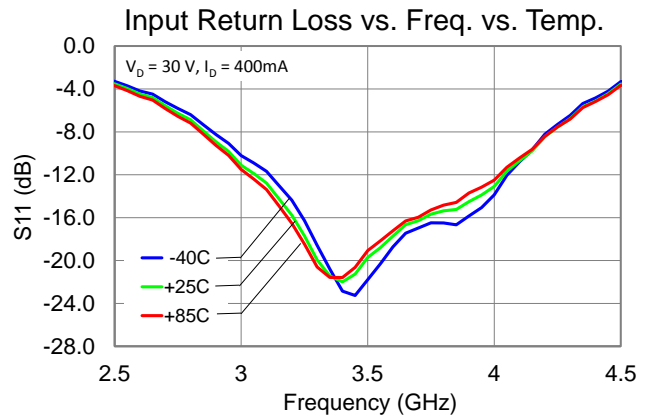
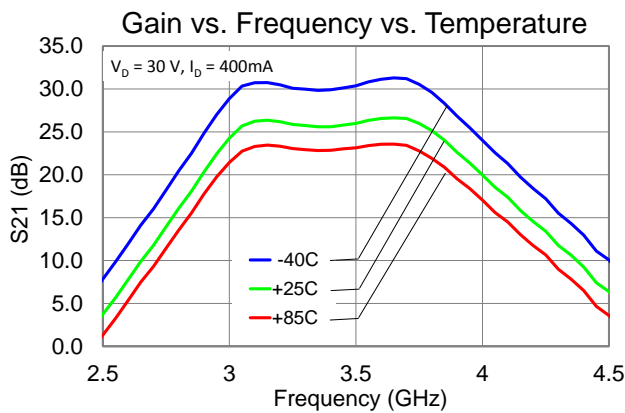
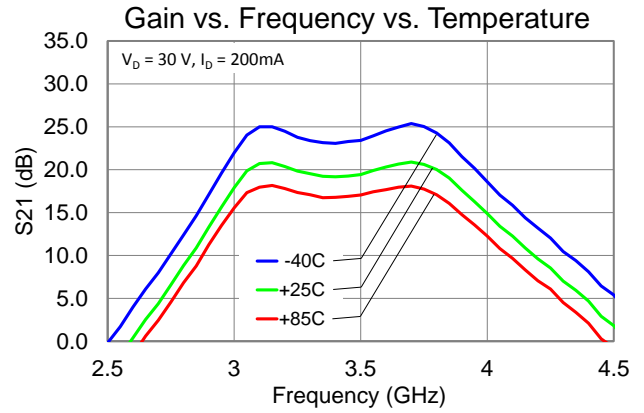
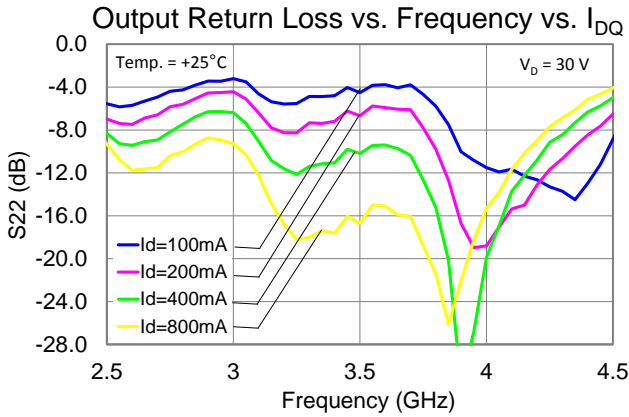
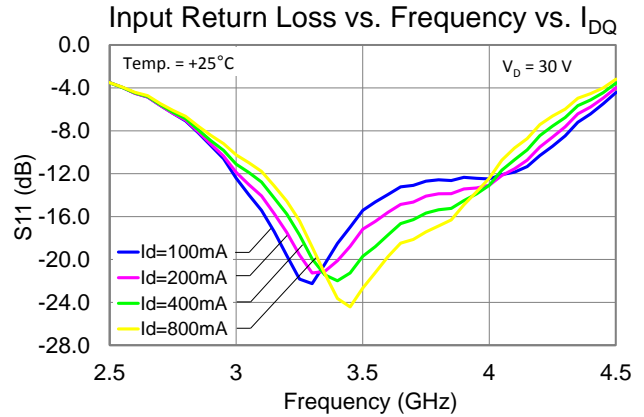
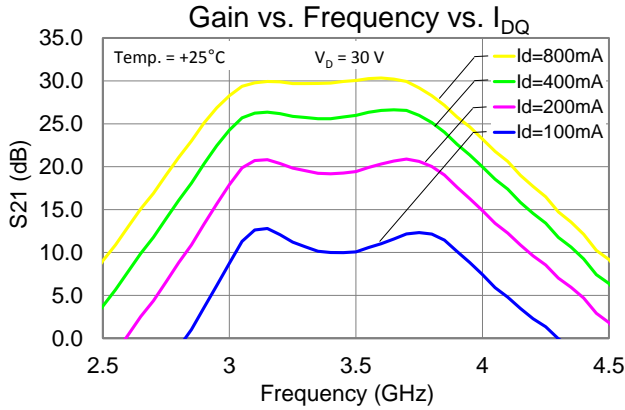
1. Thermal resistance measured to back of carrier plate. MMIC mounted on 20 mils CuMo (80/20) carrier using 1.5 mil AuSn.

### Median Lifetime

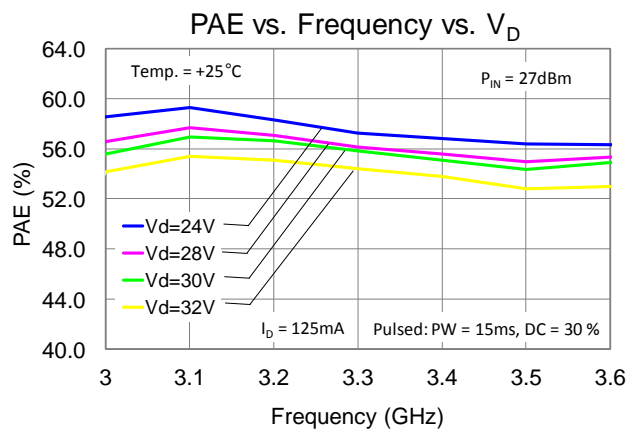
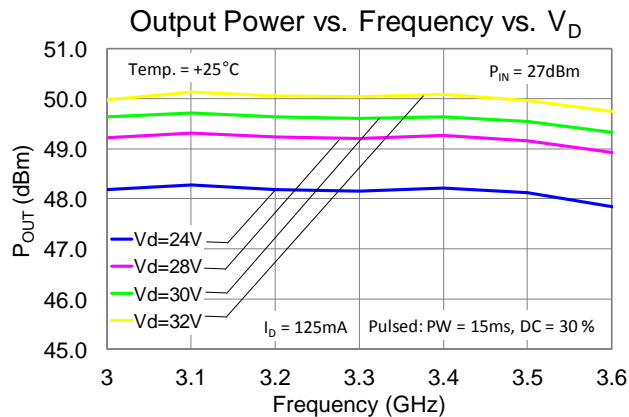
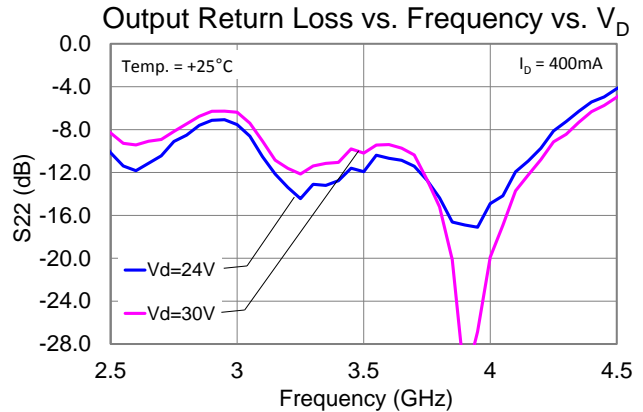
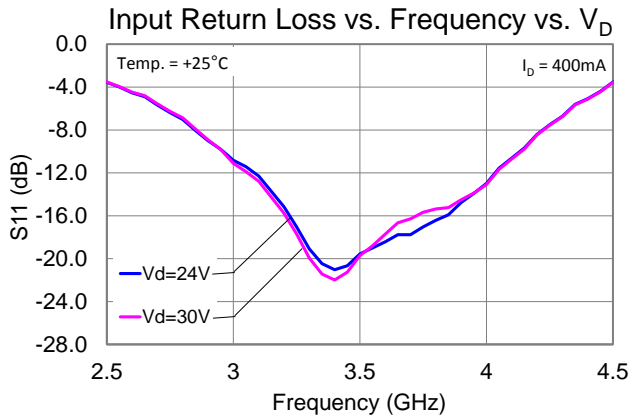
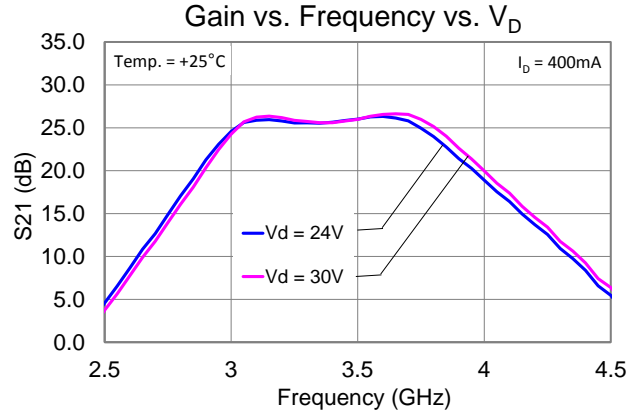
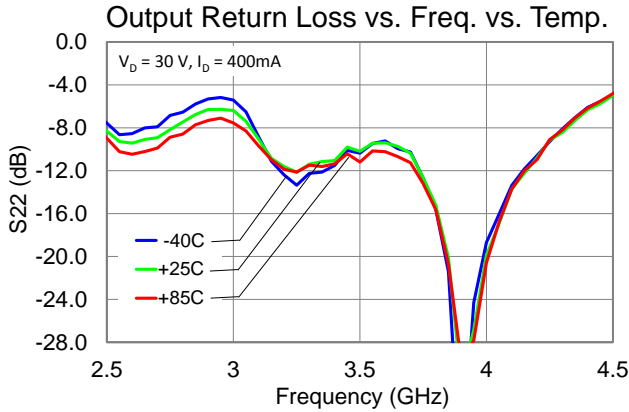
Test Conditions:  $V_D = 40\text{ V}$ ; Failure Criteria = 10% reduction in  $I_{D\_MAX}$



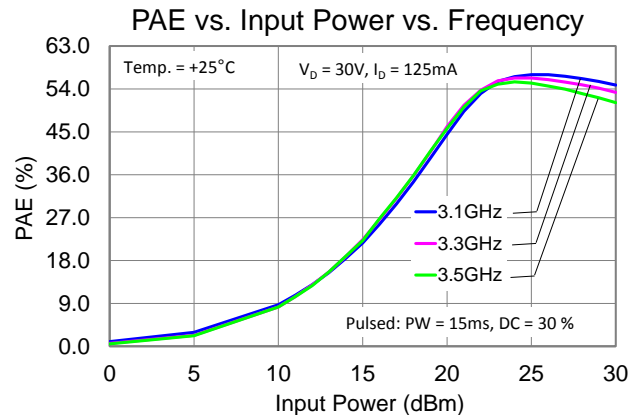
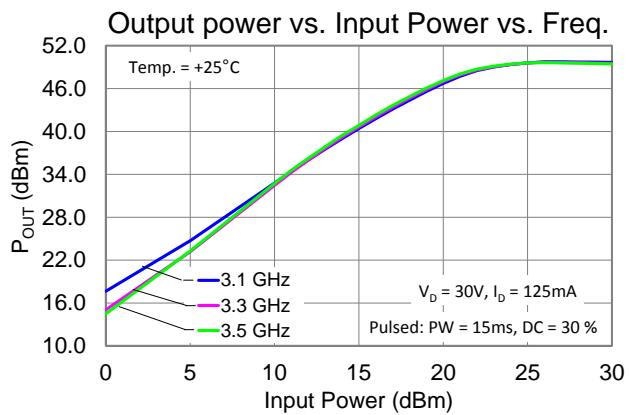
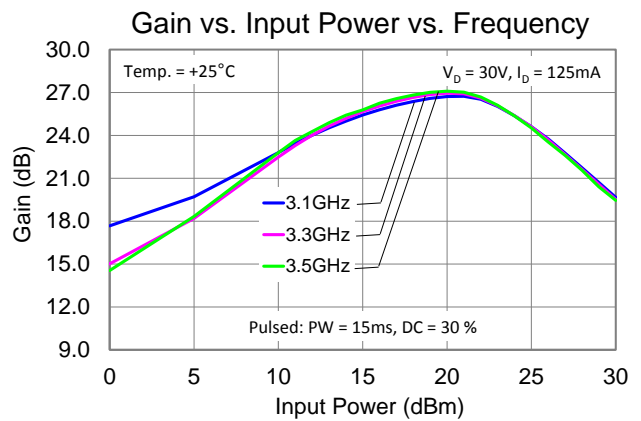
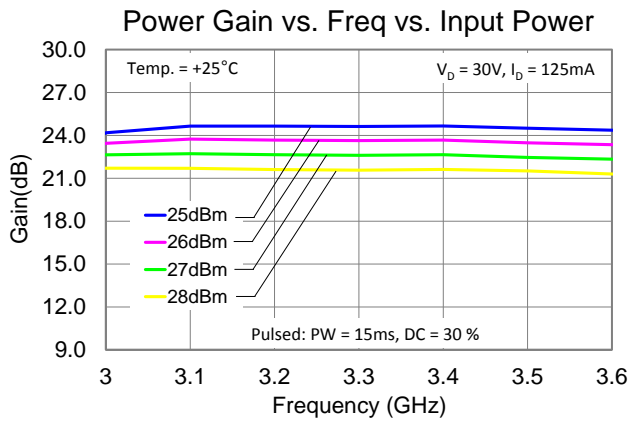
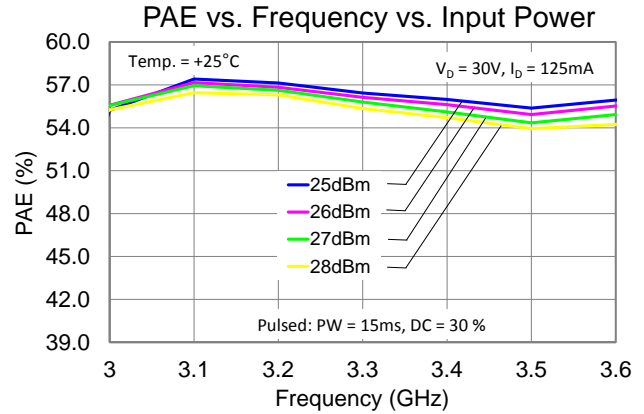
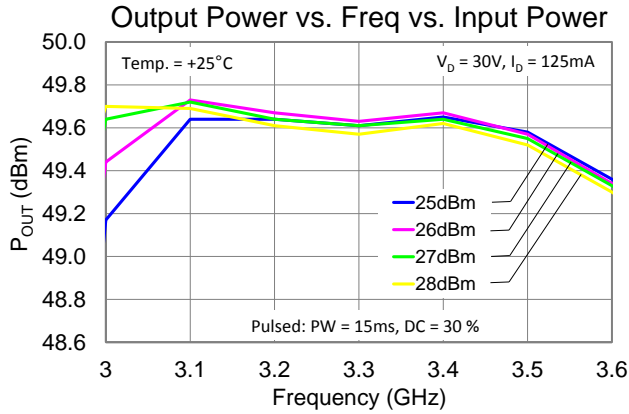
**Typical Performance**



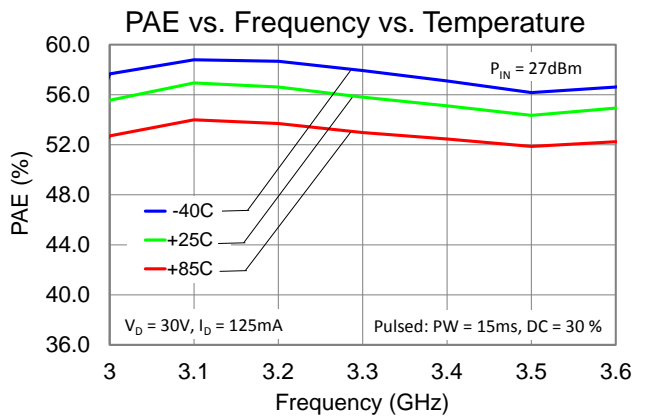
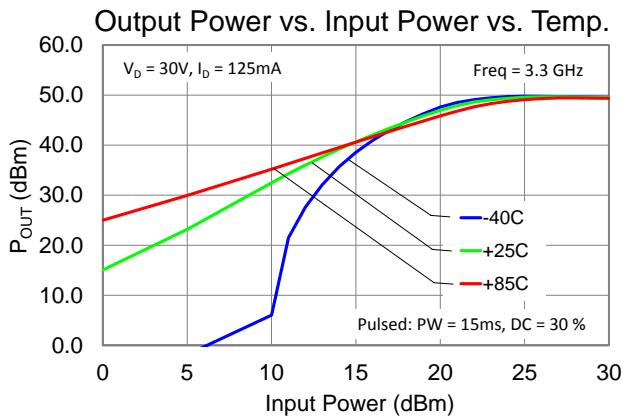
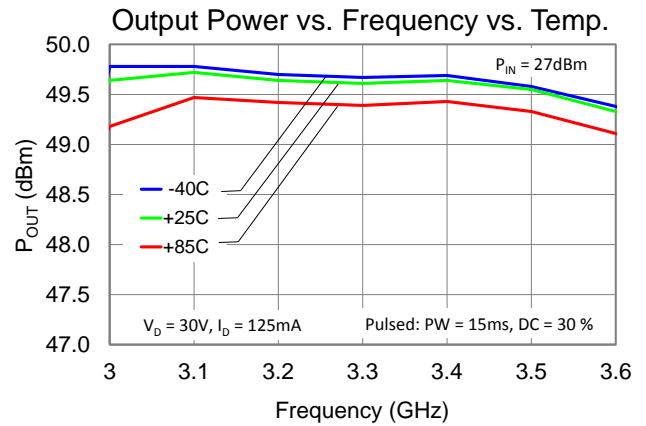
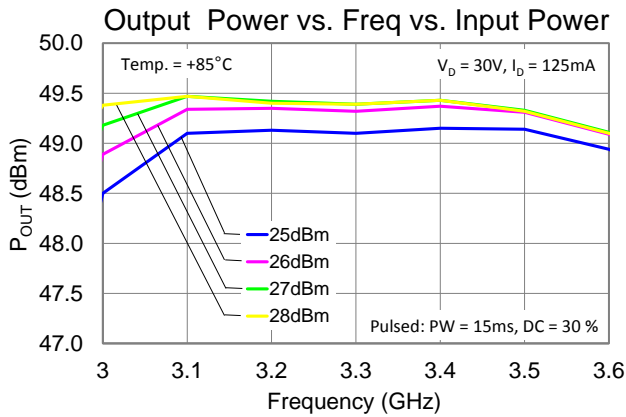
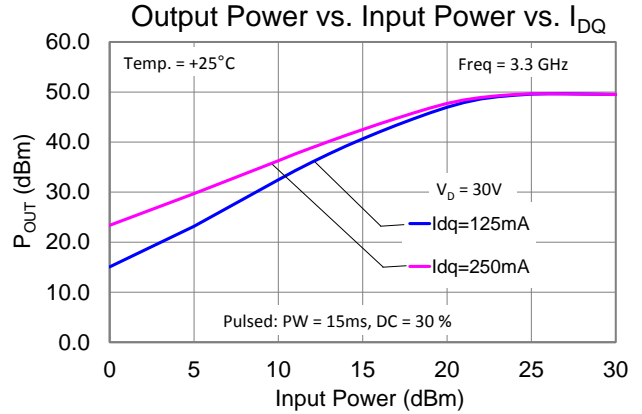
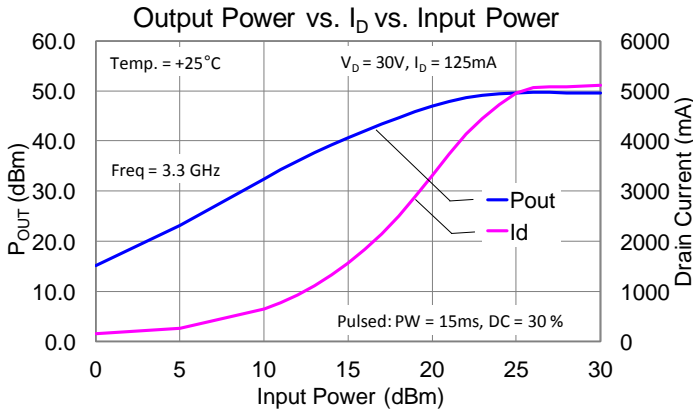
**Typical Performance**



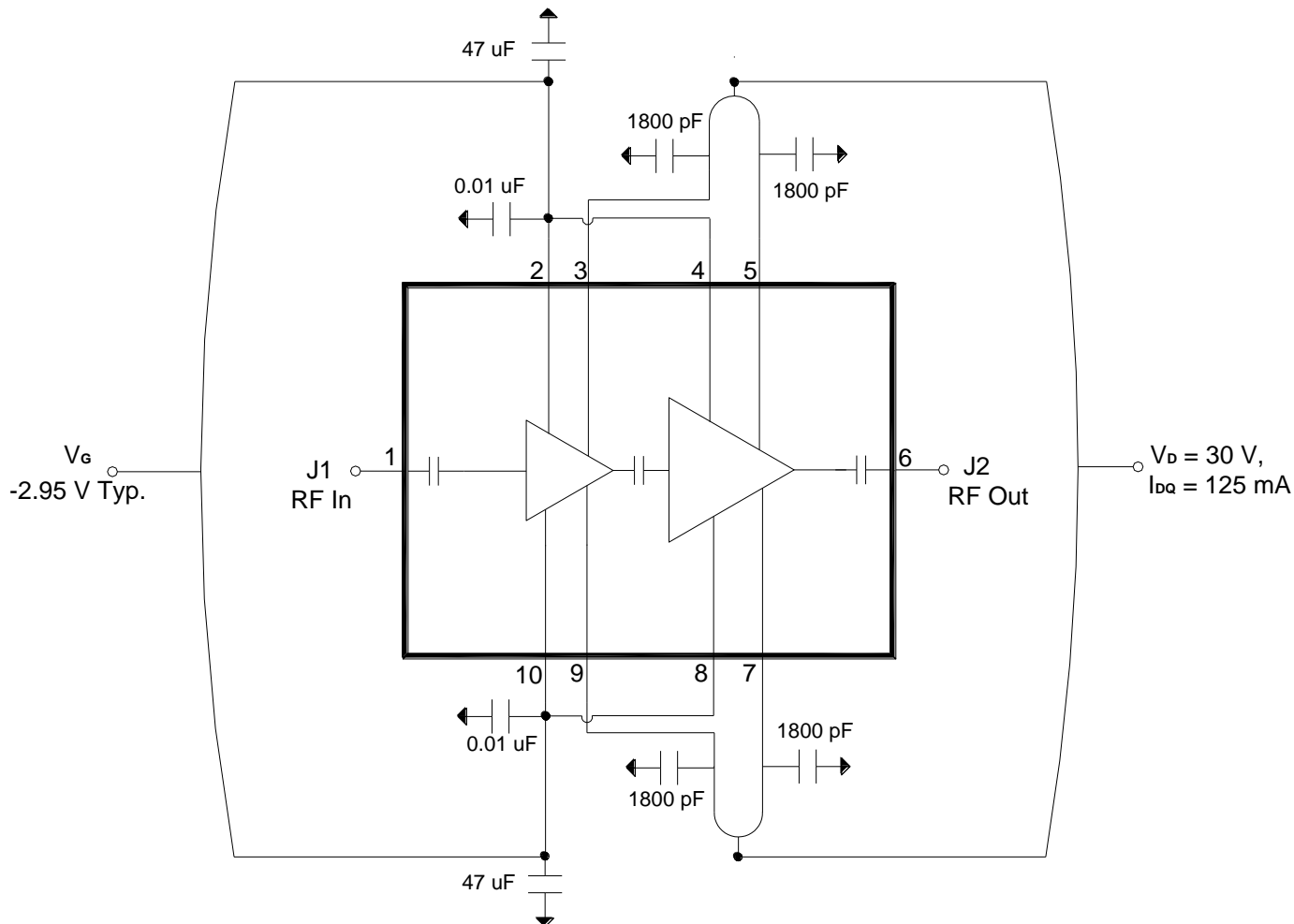
**Typical Performance**



**Typical Performance**



**Application Circuit**



**Bias-up Procedure**

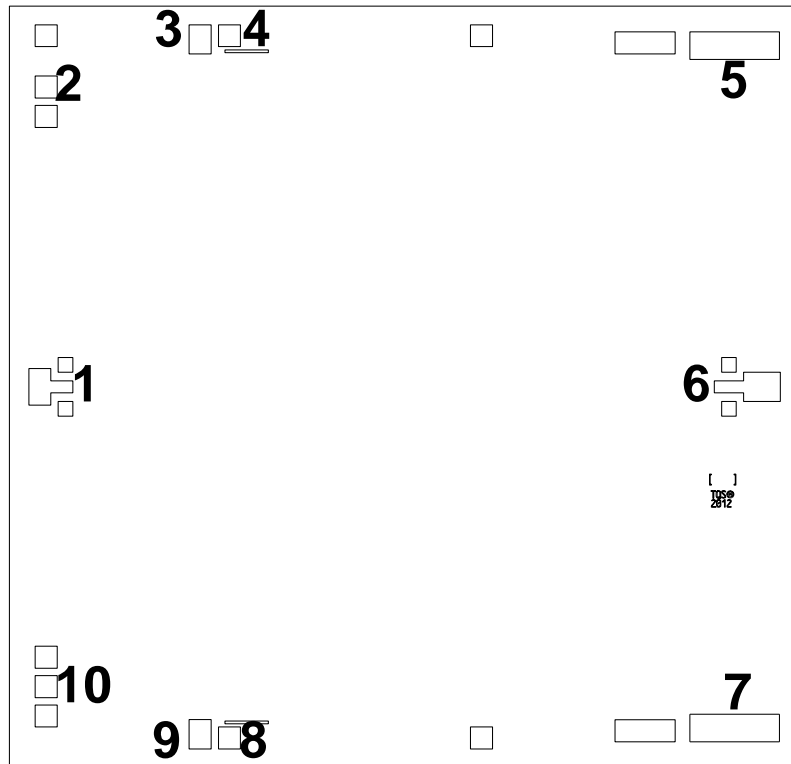
1. Set  $I_D$  limit to 6 A,  $I_G$  limit to 30 mA
2. Apply -5.0 V to  $V_G$
3. Apply +30 V to  $V_D$
4. Adjust  $V_G$  more positive until  $I_{DQ} = 125$  mA ( $V_G \sim -2.95$  V Typical)
5. Apply RF signal

**Bias-down Procedure**

1. Turn off RF signal
2. Reduce  $V_G$  to -5.0 V. Ensure  $I_{DQ} \sim 0$  mA
3. Set  $V_D$  to 0 V
4. Turn off  $V_D$  supply
5. Turn off  $V_G$  supply

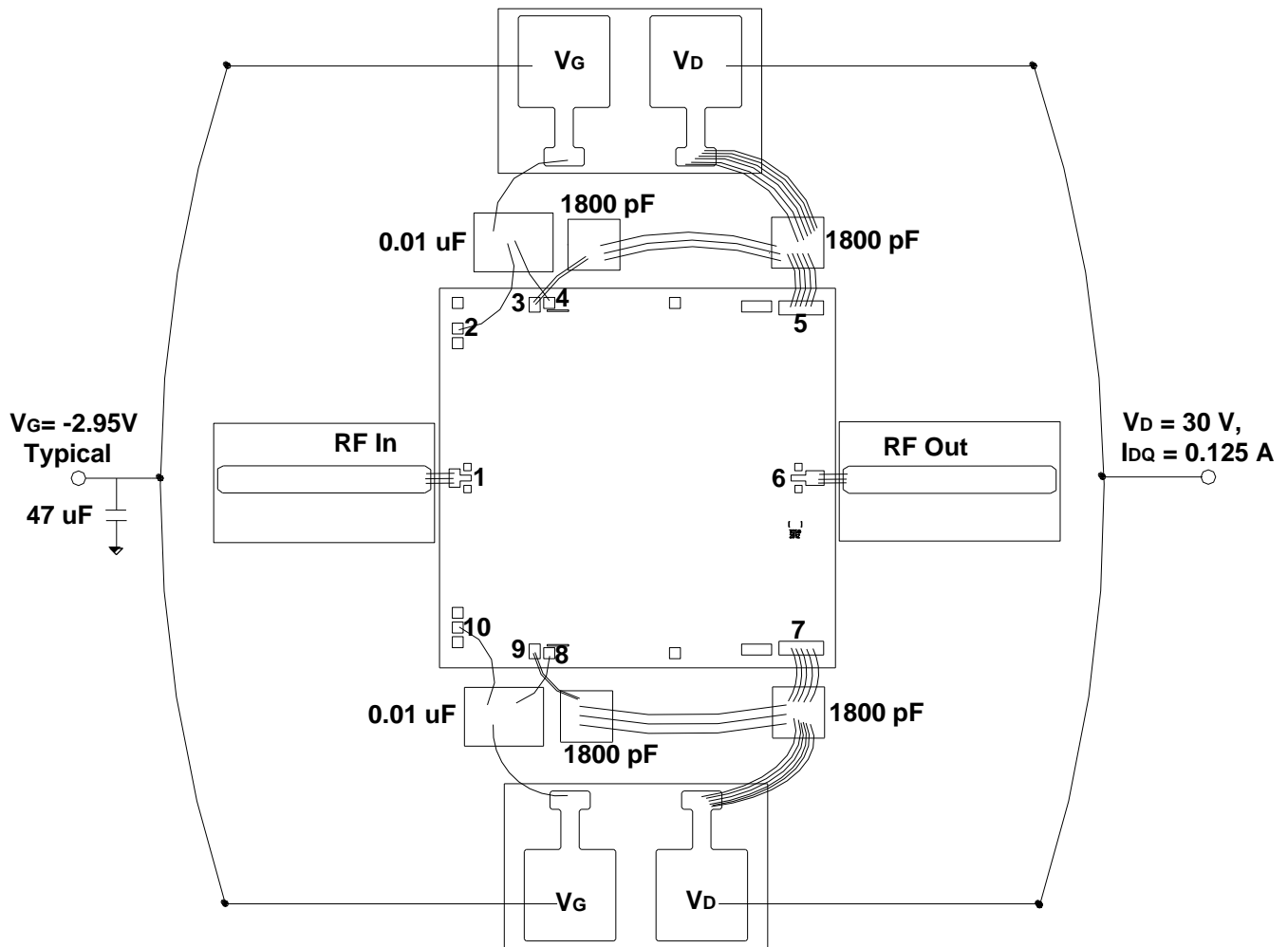


**Bond Pad Description**

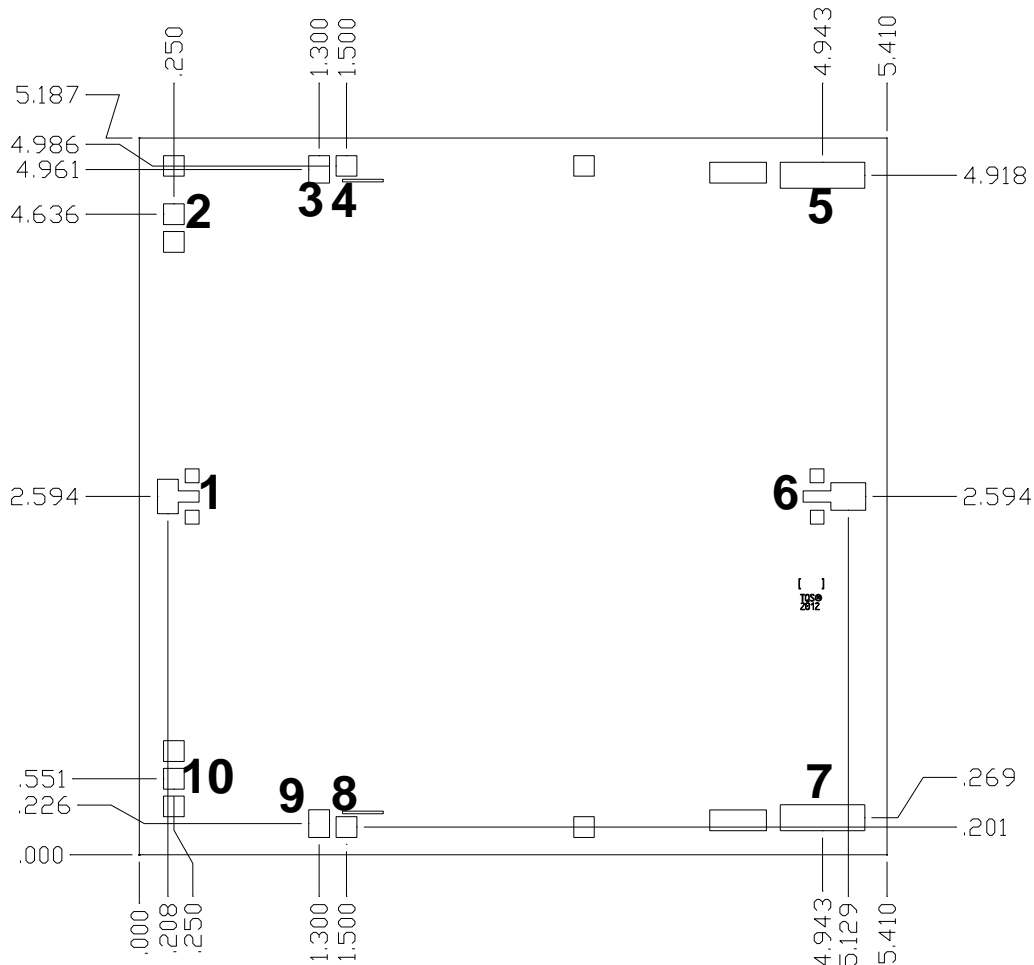


Bond Pad	Symbol	Description
1	RF In	Input; matched to 50 ohms; DC coupled.
2, 4, 8, 10	$V_G$	Gate voltage, $V_G$ top and bottom. Bias network is required; must be biased from both sides; see Application Circuit on page 8 as an example.
3, 5, 7, 9	$V_D$	Drain voltage, $V_D$ top and bottom. Bias network is required; must be biased from both sides; see Application Circuit on page 8 as an example.
6	RF Out	Output; matched to 50 ohms; DC coupled.

**Assembly Drawing**



### Mechanical Drawing



Unit: millimeters

Thickness: 0.10

Die x, y size tolerance: +/- 0.050

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

Ground is backside of die

Bond Pad	Symbol	Pad Size	Bond Pad	Symbol	Pad Size
1	RF In	0.150 x 0.250	8	RF Out	0.250 x 0.200
2, 4, 8 10	V <sub>G</sub>	0.150 x 0.150	5, 7	V <sub>D</sub>	0.610 x 0.190
3, 9	V <sub>D</sub>	0.150 x 0.200			

## Assembly Notes

Component placement and adhesive attachment assembly notes:

- Vacuum pencils and/or vacuum collets are the preferred method of pick up.
- Air bridges must be avoided during placement.
- The force impact is critical during auto placement.
- Organic attachment (i.e. epoxy) can be used in low-power applications.
- Curing should be done in a convection oven; proper exhaust is a safety concern.

Reflow process assembly notes:

- Use AuSn (80/20) solder and limit exposure to temperatures above 300°C to 3-4 minutes, maximum.
- An alloy station or conveyor furnace with reducing atmosphere should be used.
- Do not use any kind of flux.
- Coefficient of thermal expansion matching is critical for long-term reliability.
- Devices must be stored in a dry nitrogen atmosphere.

Interconnect process assembly notes:

- Thermosonic ball bonding is the preferred interconnect technique.
- Force, time, and ultrasonic are critical parameters.
- Aluminum wire should not be used.
- Devices with small pad sizes should be bonded with 0.0007-inch wire.