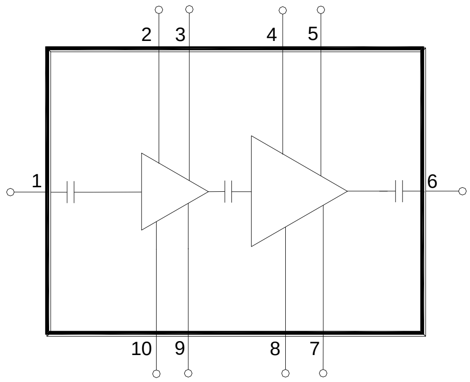
Applications

- Radar

Product Features

- Frequency Range: 3.1 – 3.6GHz
- P_{SAT}: 50.7dBm
- Power Gain: > 22dB
- PAE: 55%
- Bias: V_D = 30V, I_{DQ} = 150mA, V_G = -3.0V Typical
- Characterized at PW = 15ms and DC = 30%
- Chip Dimensions: 5.41 x 6.7 x 0.10 mm

Functional Block Diagram



General Description

TriQuint's TGA2813 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 TGA2813 provides 100W of saturated output power and 22dB of large-signal gain while achieving 55% power-added efficiency.

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The TGA2813 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 TGA2813 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
TGA2813	3A001.b.2.a	3.1 – 3.6GHz 100W GaN Power Amplifier

Absolute Maximum Ratings

Parameter	Value
Drain Voltage (V_D)	40V
Gate Voltage Range (V_G)	-8 to 0V
Drain Current (I_D)	10.4A
Gate Current (I_G)	-8 to 56mA
Power Dissipation (P_{DISS})	222W
Input Power, CW, 50 Ω, 85 °C, (P_{IN})	30dBm
Input Power, VSWR 3:1, V_D = 36V, PW = 100us, DC = 10%, 85 °C, (P_{IN})	28dBm
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)	30V
Drain Current (I_{DQ})	150mA
Drain Current Under RF Drive (I_{D_Drive})	6550mA
Gate Voltage (V_G)	-3.0V (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^{0}C, V_D = 30V, I_{DQ} = 150 mA, V_G = -3.0V 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 (Pin = 28dBm)		>22		dB
Output Power @ Saturation (Pin = 28dBm)		50.7		dBm
Power Added Efficiency (Pin = 28dBm)		55		%
Output Power Temperature Coefficient		-0.005		dBm/°C

Thermal and Reliability Information

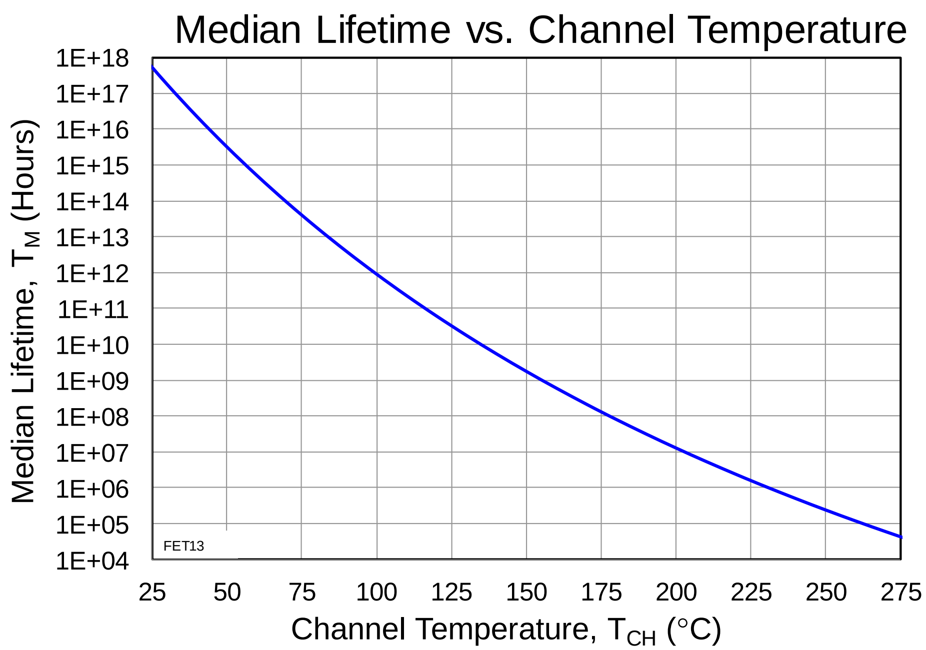
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) [1]	T_{base} = 85°C, **V_D = 30V**, $I_{D\ Drive}$ = 6.55A, Pout = 50.7dBm, P_{DISS} = 78W, Pulsed: PW = 15ms, DC = 30%	0.86	ºC/W
Channel Temperature (T_{CH})		152	°C
Median Lifetime (T_M)		1.41 x 10^9	Hrs
Thermal Resistance (θ_{JC}) [1]	T_{base} = 85°C, **V_D = 32V**, $I_{D\ Drive}$ = 6.85A, Pout = 51.1dBm, P_{DISS} = 89W, Pulsed: PW = 15ms, DC = 30%	0.90	ºC/W
Channel Temperature (T_{CH})		166	°C
Median Lifetime (T_M)		3.21 x 10^8	Hrs

Notes:

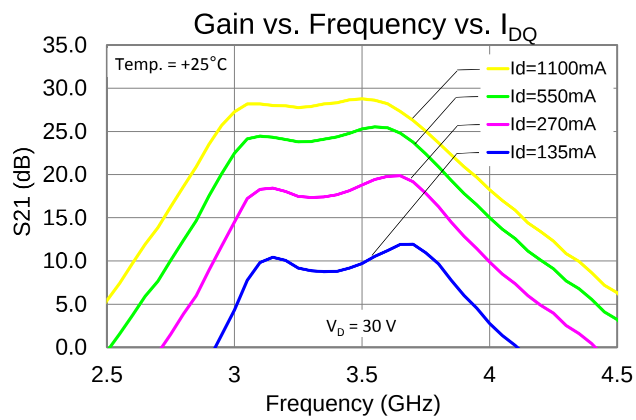
1. Thermal resistance measured to back of carrier plate. MMIC mounted on 20 mils CuMo (80/20) carrier using 1.5 mil AuSn.

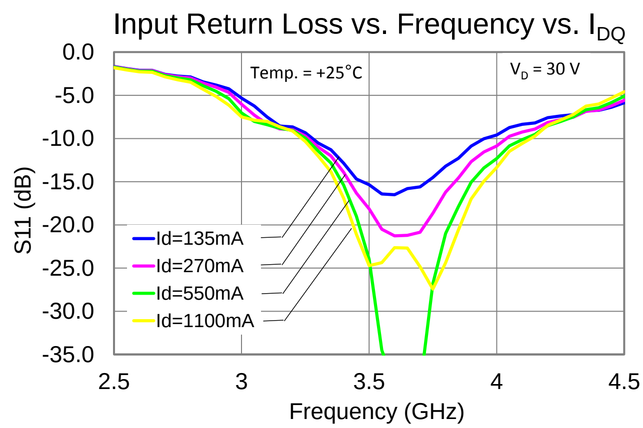
Median Lifetime

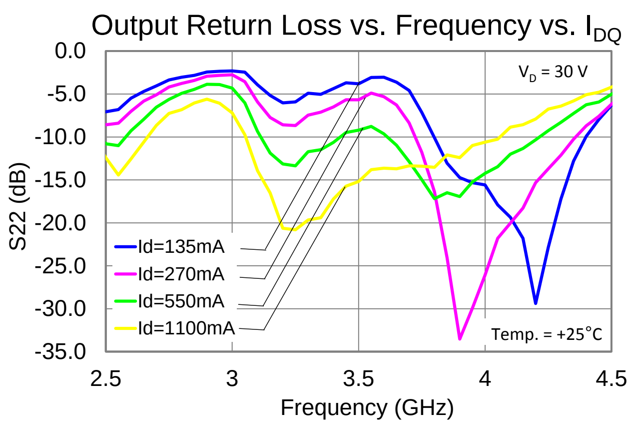
Test conditions: V_D = 40V; Failure Criteria = 10% reduction in I_{D_MAX}

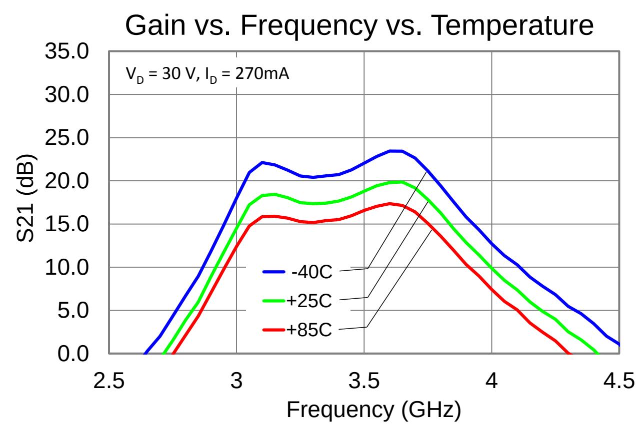


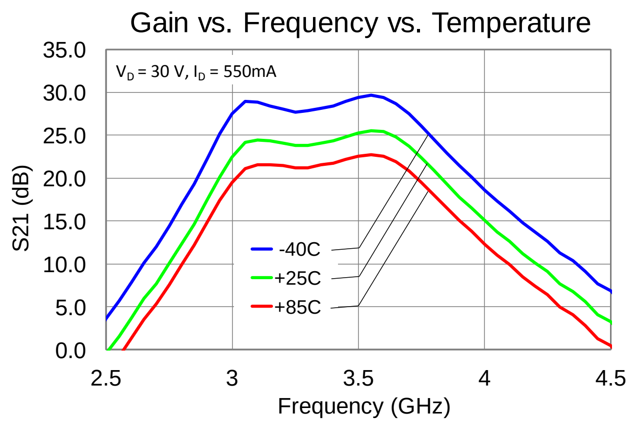
Typical Performance

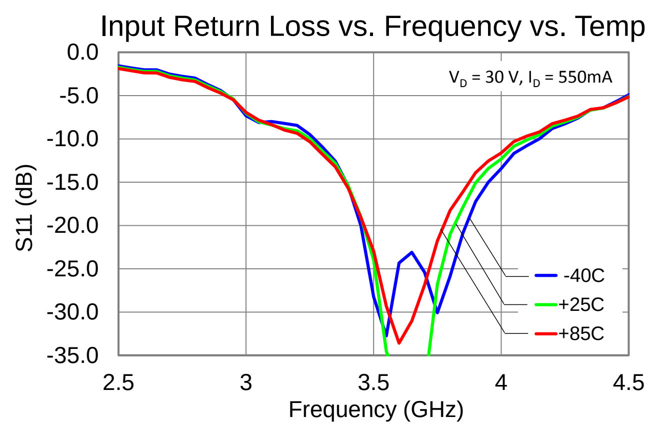












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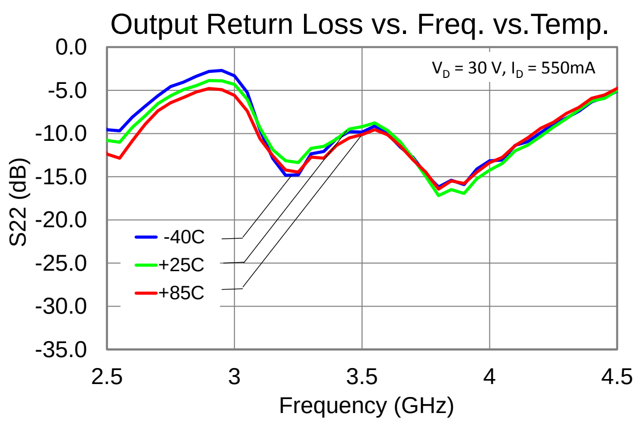
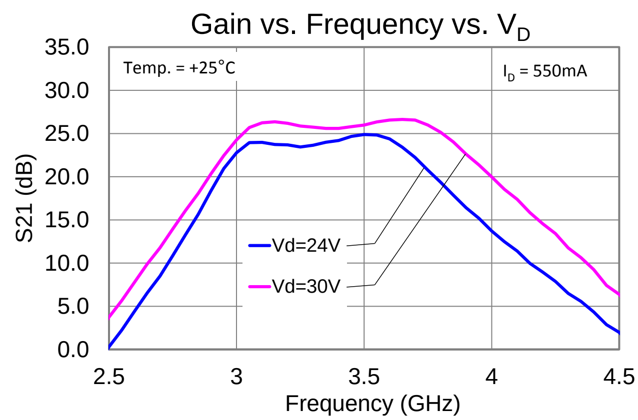
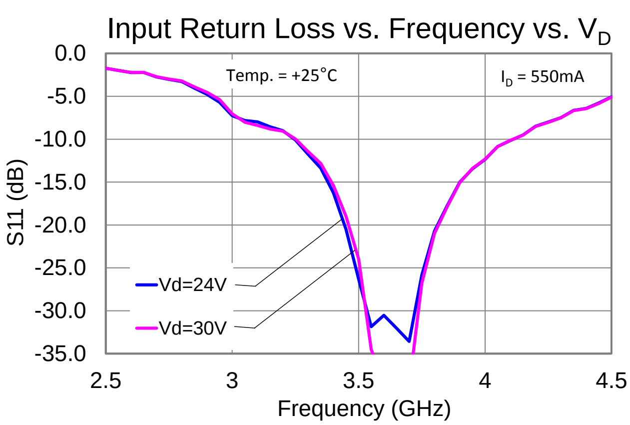
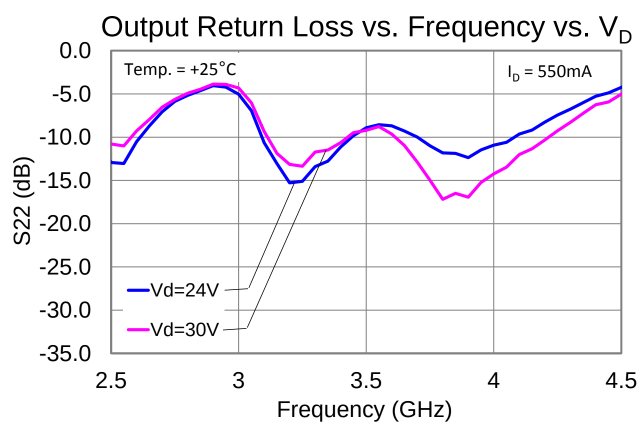
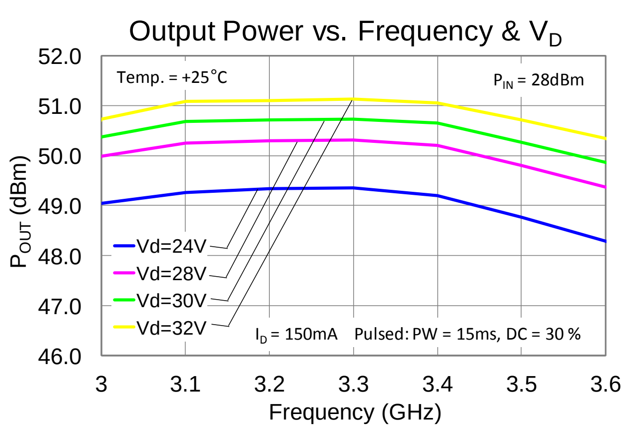
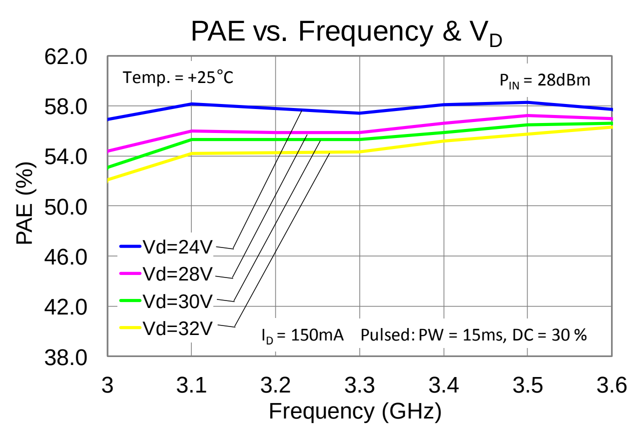






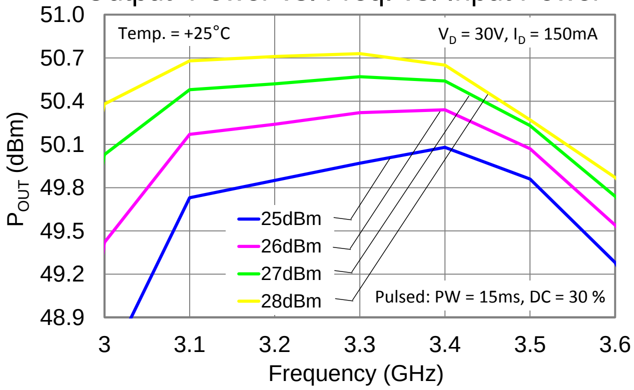




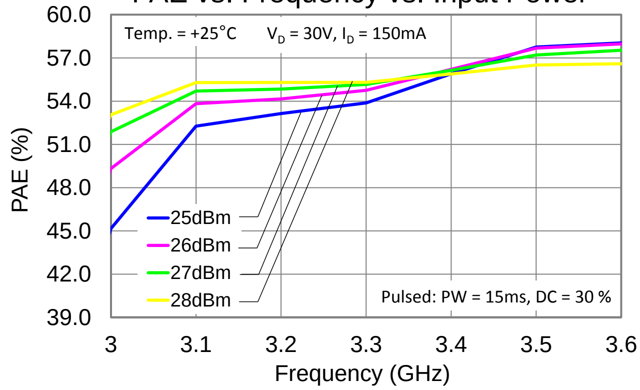


Typical Performance

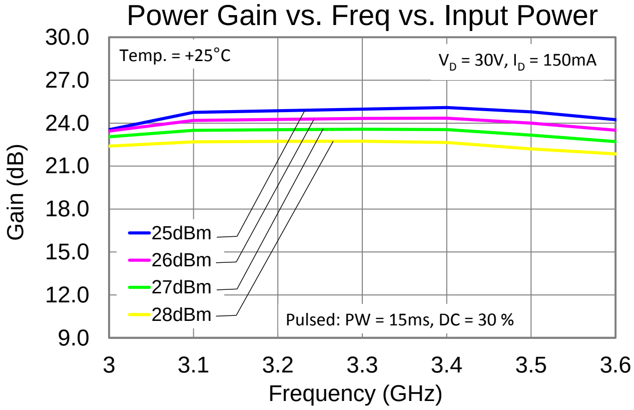
Output Power vs. Freq. vs. Input Power



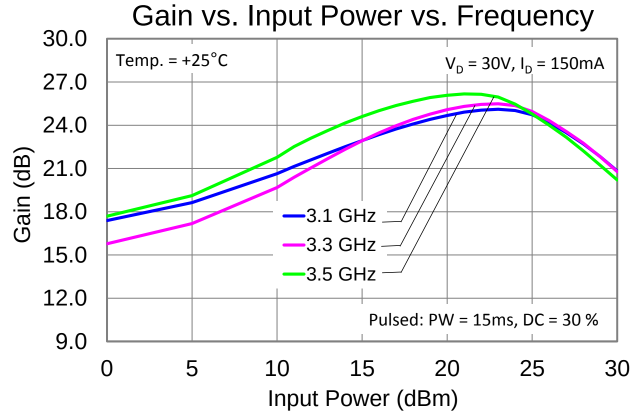
PAE vs. Frequency vs. Input Power



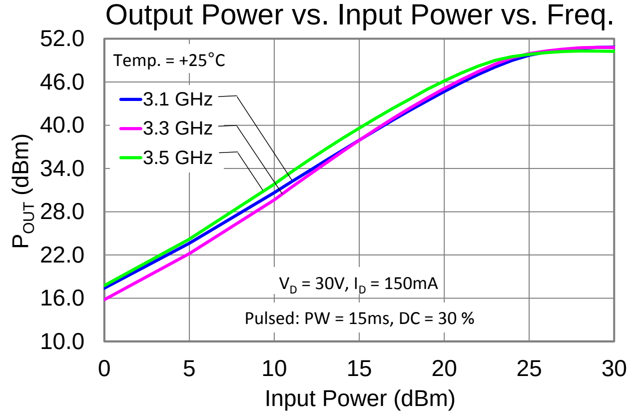
Power Gain vs. Freq vs. Input Power



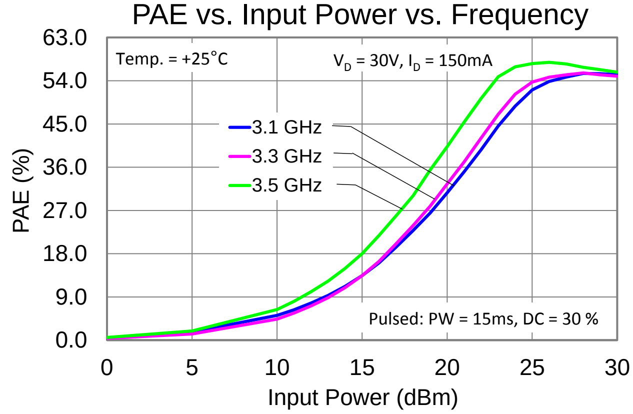
Gain vs. Input Power vs. Frequency



Output Power vs. Input Power vs. Freq.



PAE vs. Input Power vs. Frequency



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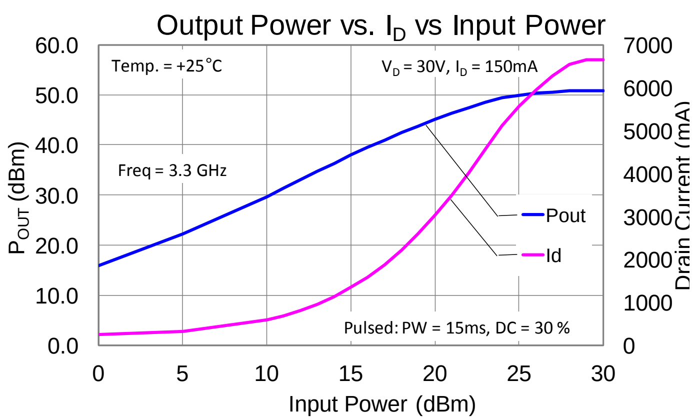
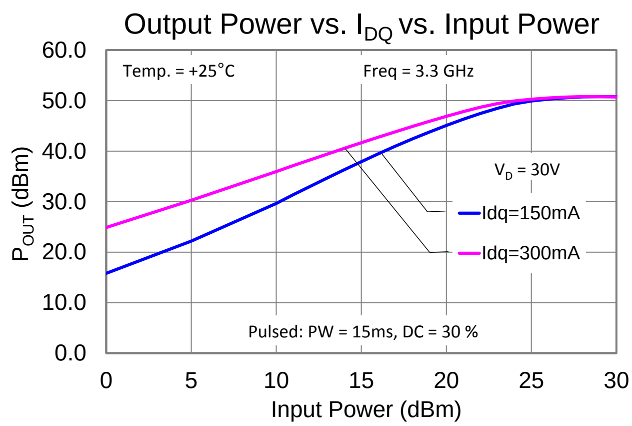
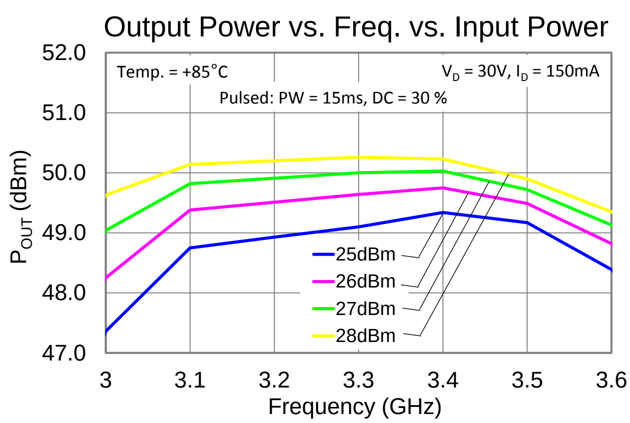
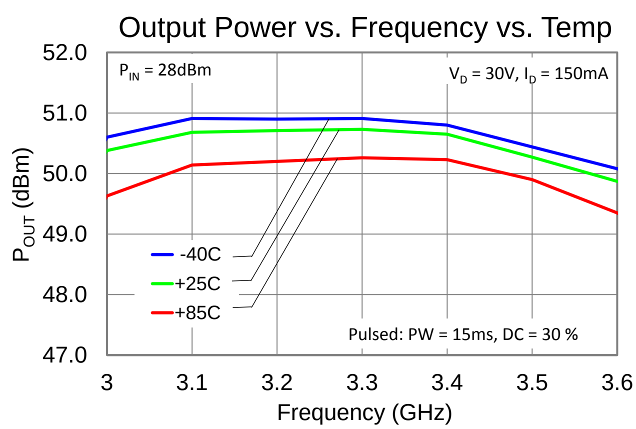
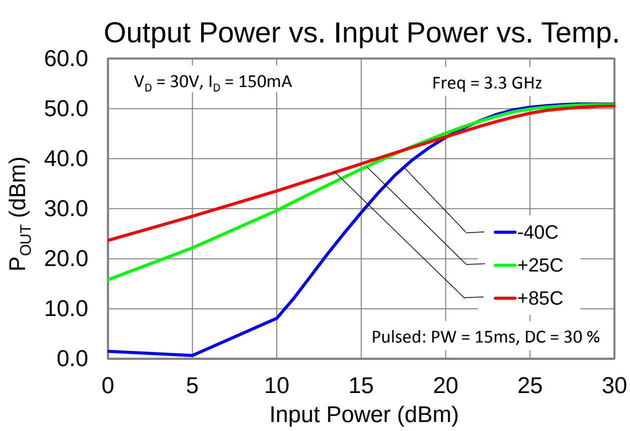
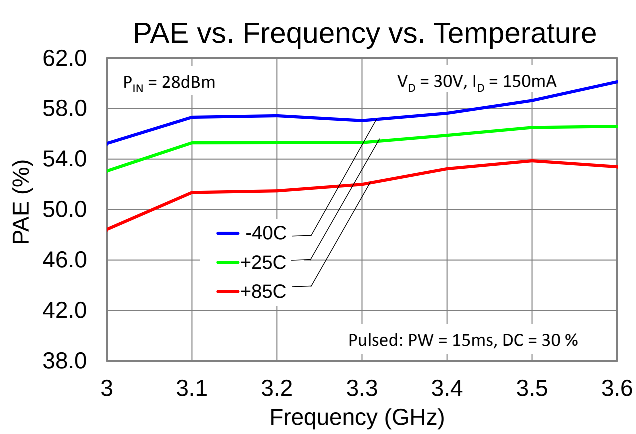




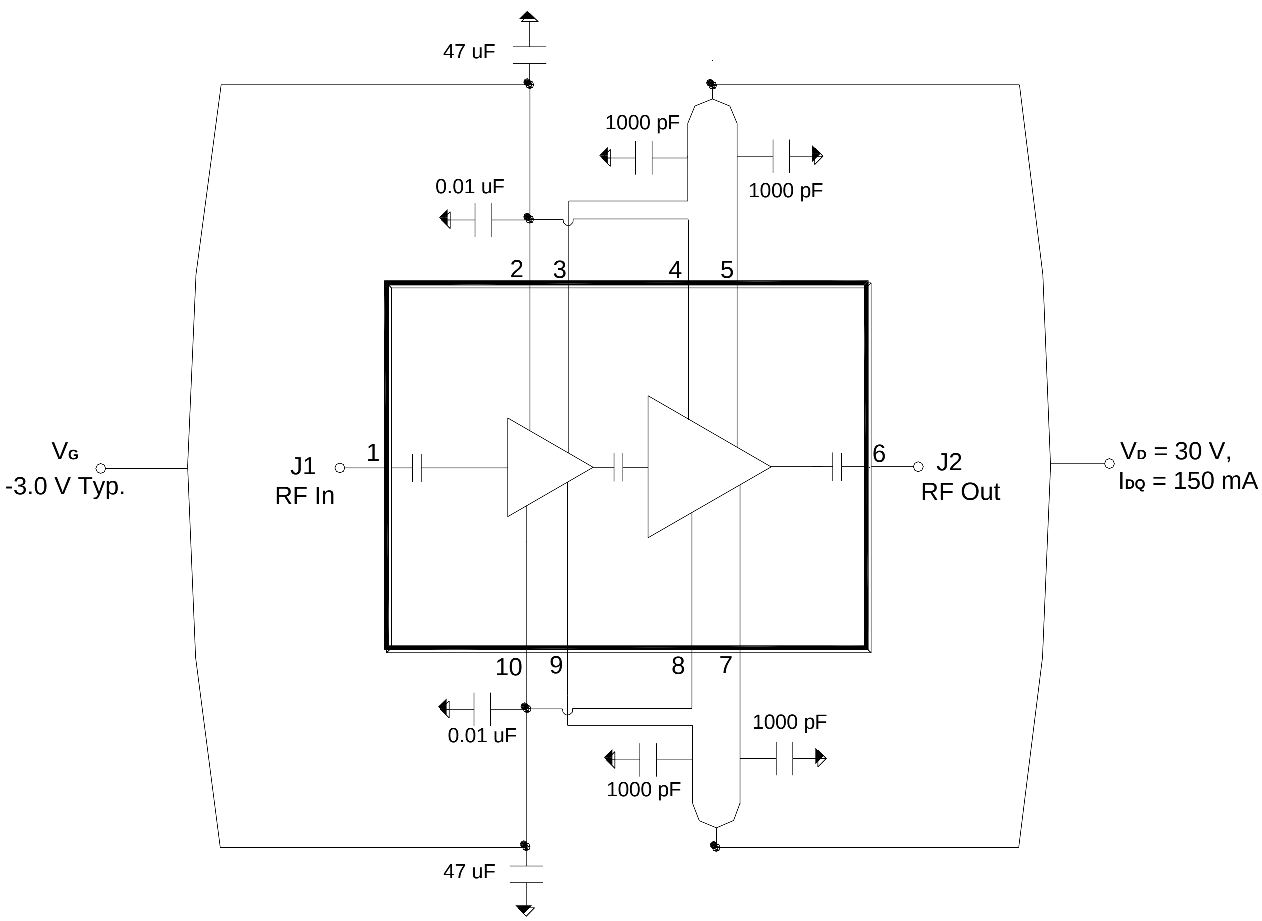








Application Circuit



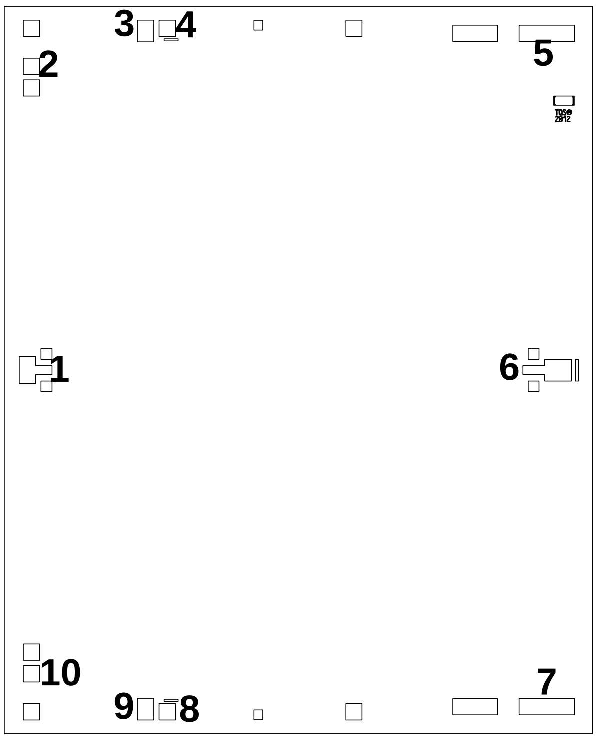
Bias-up Procedure

1. Set I_D limit to 7.5A, I_G limit to 30mA
2. Apply -5.0V to V_G
3. Apply +30V to V_D
4. Adjust V_G more positive until I_{DQ} = 150 mA (V_G ~ -3.0 V Typical)
5. Apply RF signal

Bias-down Procedure

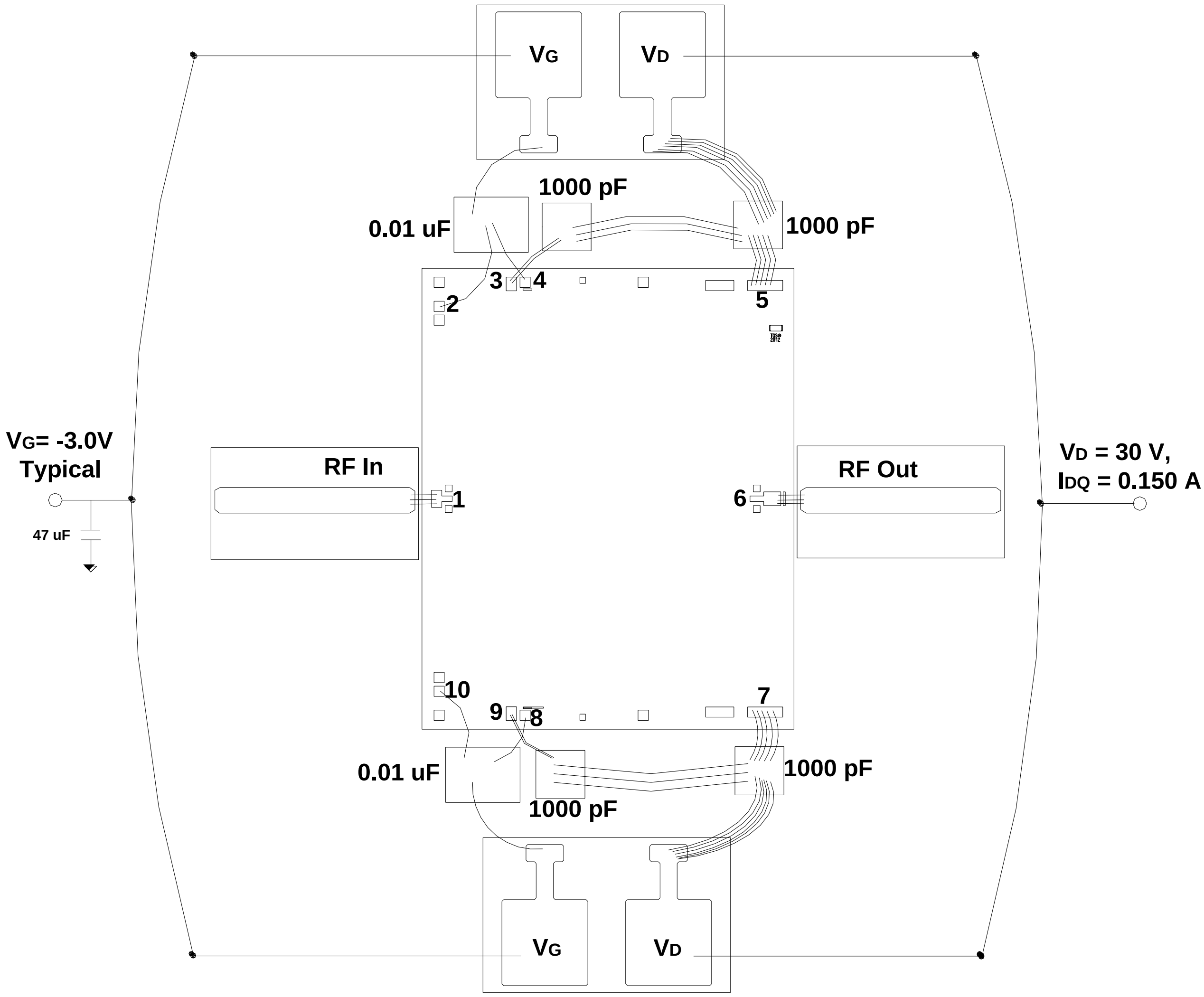
1. Turn off RF signal
2. Reduce V_G to -5.0V. Ensure I_{DQ} ~ 0mA
3. Set V_D to 0V
4. Turn off V_D supply
5. Turn off V_G supply

Bond Pad Description

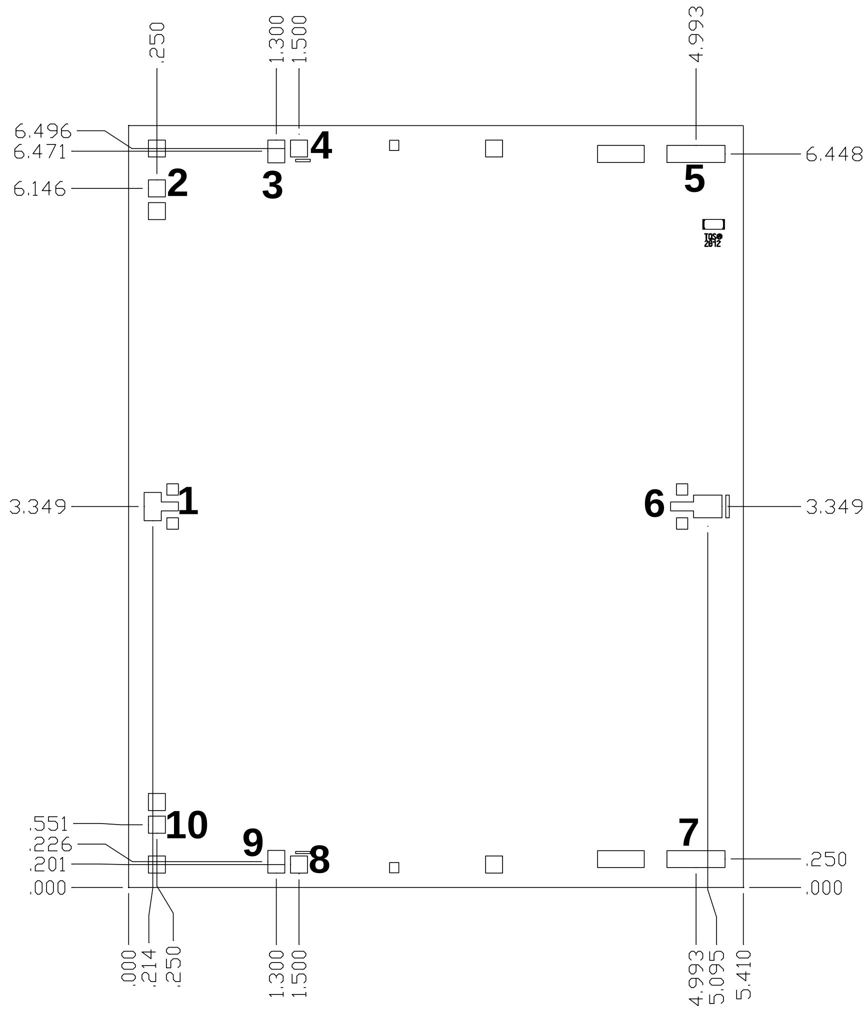


Bond Pad	Symbol	Description
1	RF In	Input; matched to 50 ohms; DC coupled.
2, 4, 8, 10	V_G	Gate voltage, V_G top and bottom. Bias network is required; must be biased from both sides; see Application Circuit on page 8 as an example.
3, 5, 7, 9	V_D	Drain voltage, V_D top and bottom. Bias network is required; 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_G	0.150 x 0.150	5, 7	V_D	0.510 x 0.150
3, 9	V_D	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.