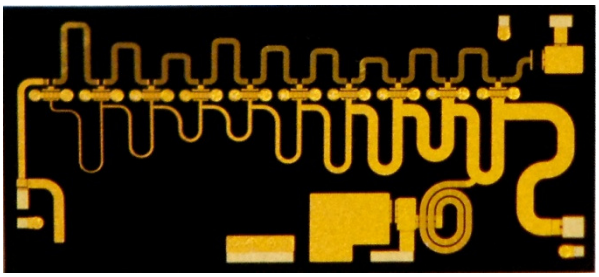
# TGA2573

## *2-18 GHz 10 Watt GaN Amplifier*

## Applications

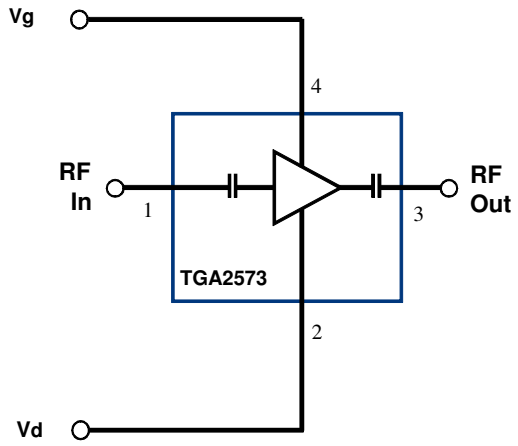
- Military Radar
- Communications
- Electronic warfare
- Electronic counter measures
- Test Equipment



## Product Features

- Frequency Range: 2 – 18 GHz
- Psat: 40.0 dBm at Vd=30 V
- PAE: 25% typical
- Small Signal Gain: 9 dB
- Return Loss: 15 dB
- Bias: Vd = 30 V, Idq = 500 mA,
  Vg = -3.4 V typical
- Technology: 0.25 µm GaN on SiC
- Dimensions: 2.55 x 5.54 x 0.1 mm

## Functional Block Diagram




## General Description

TriQuint's TGA2573 is a wideband, high power GaN HEMT amplifier fabricated on TriQuint's production 0.25um GaN on SiC process. Operating from 2 to 18 GHz, it achieves 40 dBm saturated output power, 25% PAE and 9 dB small signal gain at a drain bias of 30 volts.

Fully matched to 50 ohms and with integrated DC blocking caps on both RF ports, the TGA2573 is ideally suited to support both commercial and defense related applications.

The TGA2573 is 100% DC and RF tested on-wafer to ensure compliance to performance specifications.

Lead-free and RoHS compliant

## Bond Pad Configuration

| Bond Pad # | Symbol |
|---|---|
| 1 | RF In |
| 2 | Vd |
| 3 | RF Out |
| 4 | Vg |

## Ordering Information

| Part No. | ECCN | Description |
|---|---|---|
| TGA2573 | XI(c) | GaN on SiC Die |

# Specifications

## Absolute Maximum Ratings

| Parameter | Rating |
|---|---|
| Drain Voltage,Vd | 40 V 2/ |
| Gate Voltage,Vg | -8 to 0 V |
| Drain to Gate Voltage, Vd - Vg | 80 V |
| Drain Current, Id | 1.3 A 1/ 2/ |
| Gate Current, Ig | -4 to 11 mA |
| Power Dissipation, Pdiss | 30 W |
| RF Input Power, CW, 50Ω,T = 25ºC | 35 dBm 2/ |
| Channel Temperature, Tch | 250 °C |
| Mounting Temperature (30 Seconds) | 320 °C |
| Storage Temperature | -40 to 150 °C |
| | |

1/ Continuous operation at currents above 1.0 Amp will reduce lifetime independent of junction temperature. Contact TriQuint for more information.

2/ At certain frequencies, Id can exceed 1.0 A for Pin ≥ 33 dBm and Vd ≥ 30V.

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 | Min | Typical | Max | Units |
|---|---|---|---|---|
| Vd | | 30 | | V |
| Idq | | 500 | | mA |
| Id_drive (Under RF Drive) | | 650-1100 1/ | | mA |
| Vg | | -3.4 | | V |

1/ Continuous operation at currents above 1.0 Amp will reduce lifetime independent of junction temperature. Contact TriQuint for more information.

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

## Electrical Specifications

Test conditions unless otherwise noted: 25ºC, Vd = 30 V, Idq = 500 mA, Vg = -3.4 V Typical.

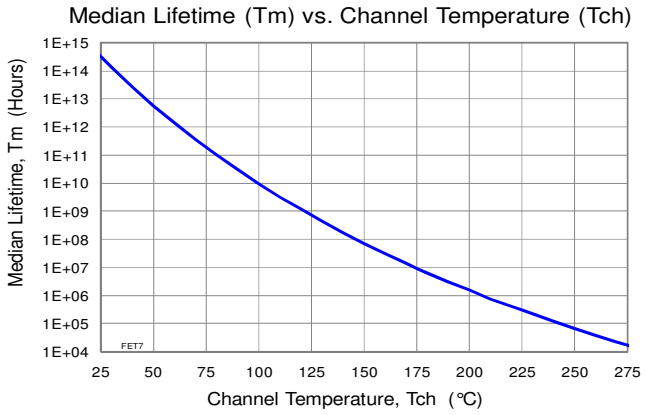
| Parameter | Min | Typical | Max | Units |
|---|---|---|---|---|
| Operational Frequency Range | 2 | | 18 | GHz |
| Small signal gain | | 9 | | dB |
| Input Return Loss | | 15 | | dB |
| Output Return Loss | | 15 | | dB |
| Output Power @ Saturation | | 40.0 | | dBm |

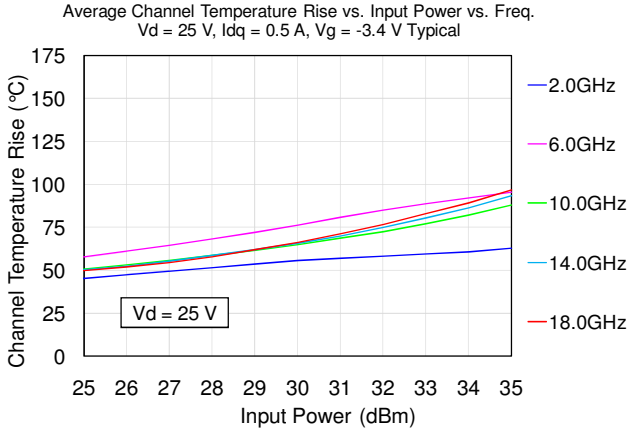
## Specifications (cont.)

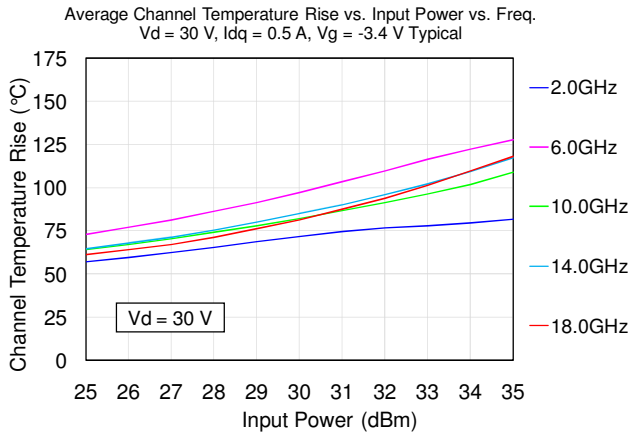
### Thermal and Reliability Information

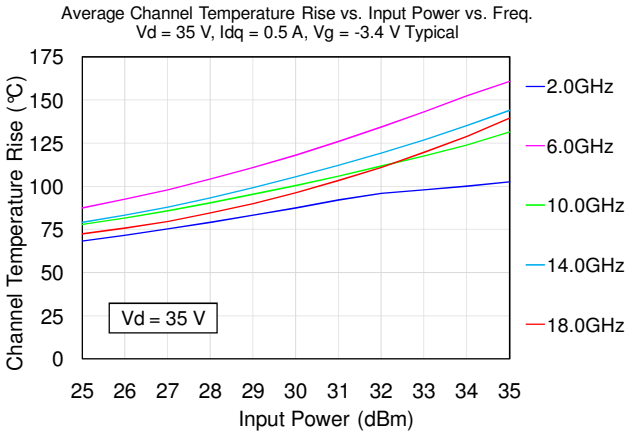
| Parameter | Condition | Rating |
|---|---|---|
| Thermal Resistance, $\theta_{JC}$, backside of die 1/ | Tbase = 70 °C | $\theta_{JC}$ = 4.9 °C/W |
| Channel Temperature (Tch), and Median Lifetime (Tm) | Tbase = 70 °C, Vd = 30 V, Idq = 500 mA, Pdiss = 15 W | Tch = 144 °C<br>Tm = 1.2E+8 Hours |
| Channel Temperature (Tch), and Median Lifetime (Tm) Under RF Drive | Tbase = 70 °C, Vd = 30 V, Id = 1100 mA, Pin=35 dBm, Pout=40dBm, Pdiss = 26.2W | Tch = 198 °C<br>Tm = 1.7E+6 Hours |
| Channel Temperature (Tch), and Median Lifetime (Tm) Under RF Drive | Tbase = 70 °C, Vd = 35 V, Id = 1250 mA, Pin=35 dBm, Pout=41.5dBm, Pdiss = 32.8W | Tch = 231 °C<br>Tm = 2.0E+5 Hours |

1/ Assumes eutectic attach of die using 1.5 mil thick 80Au/20Sn to a 40 mil thick 80Mo/20Cu carrier.



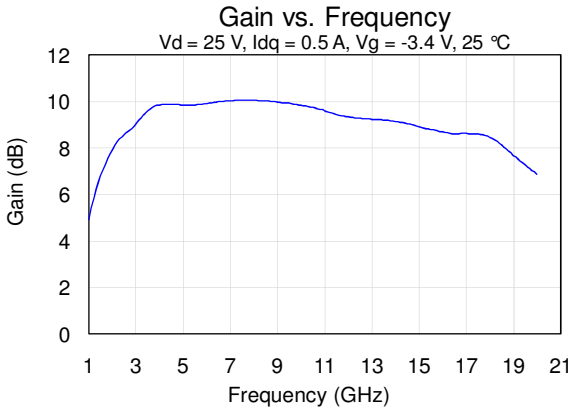



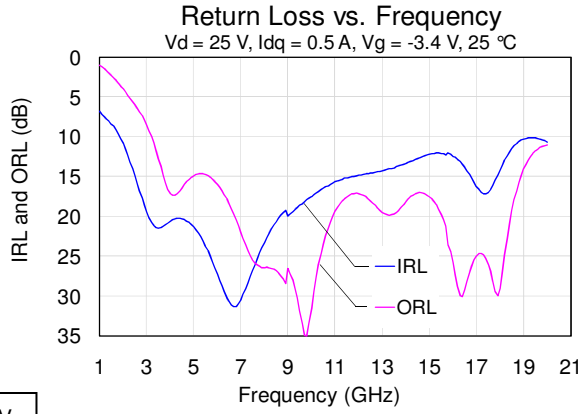



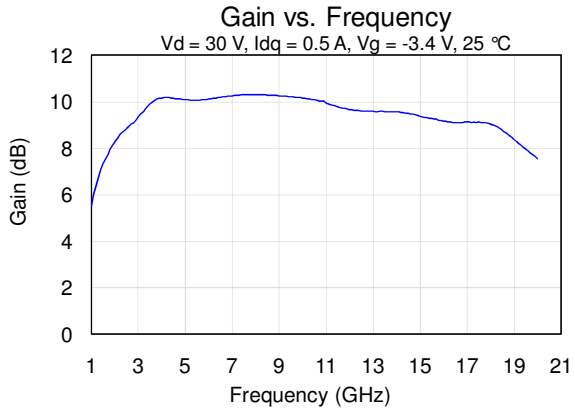
## Typical Performance

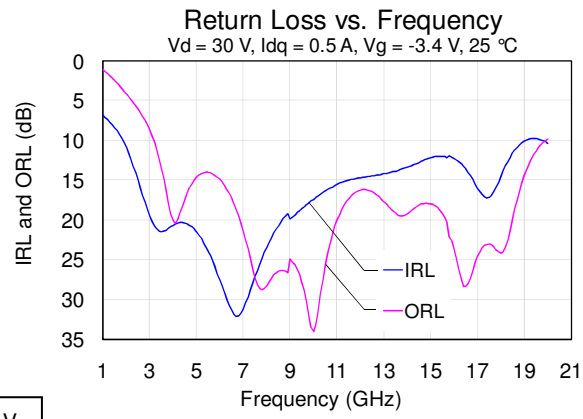
Vd = 25 V



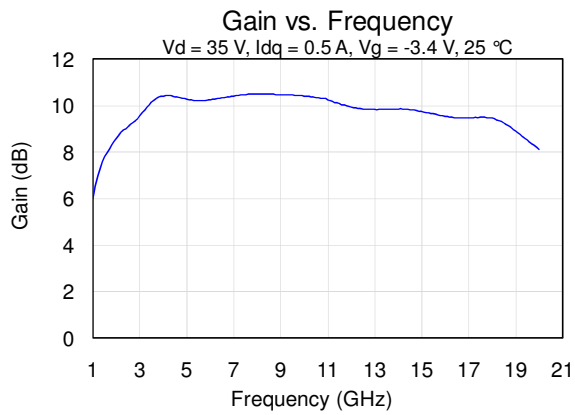



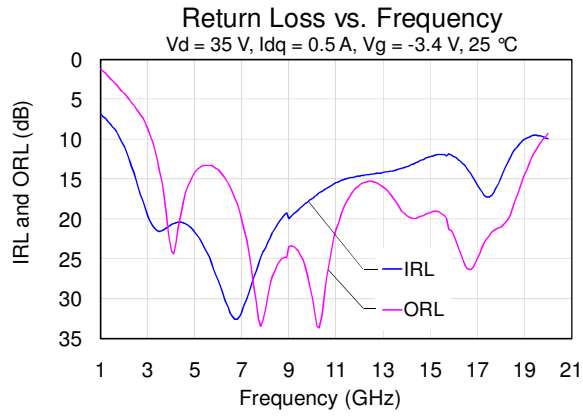

Vd = 30 V




Vd = 35 V

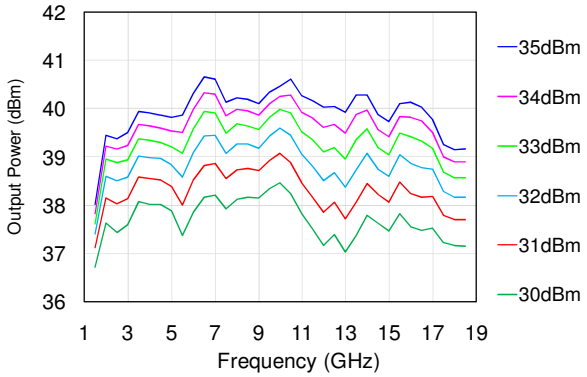


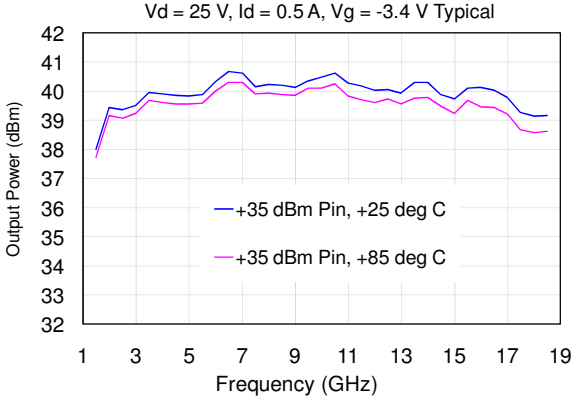
## Typical Performance (cont.)

Vd = 25 V

Output Power vs. Freq. vs. Input Power
Vd = 25 V, Id = 0.5 A, Vg = -3.4 V Typical, +25°C

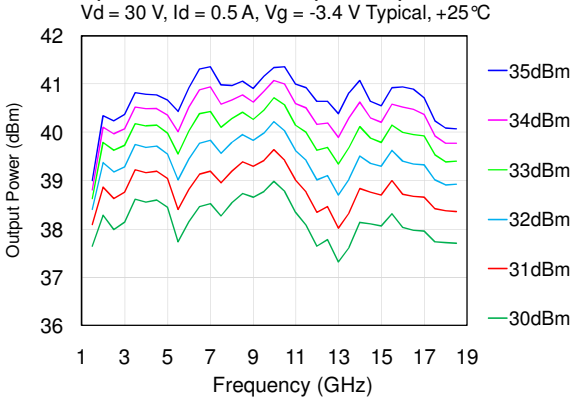



Output Power vs. Freq. vs. Temp.
Vd = 25 V, Id = 0.5 A, Vg = -3.4 V Typical

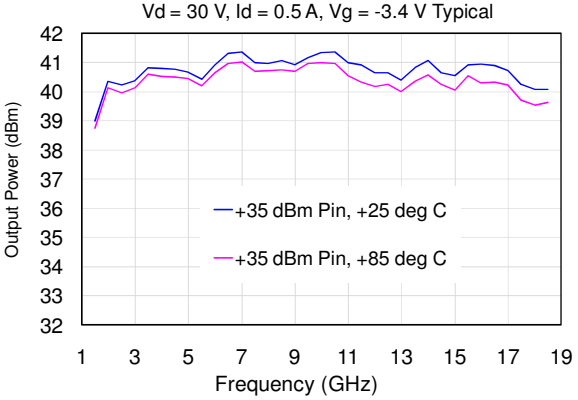



Vd = 30 V

Output Power vs. Freq. vs. Input Power
Vd = 30 V, Id = 0.5 A, Vg = -3.4 V Typical, +25°C

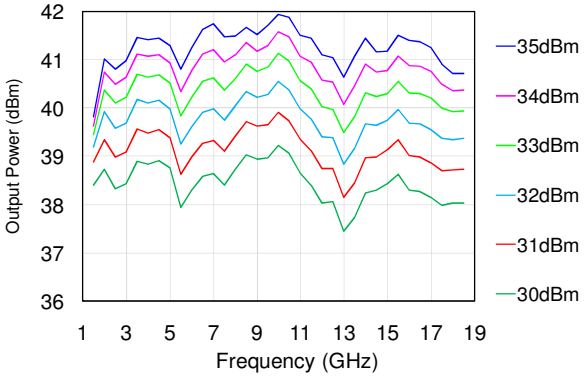



Output Power vs. Freq. vs. Temp.
Vd = 30 V, Id = 0.5 A, Vg = -3.4 V Typical

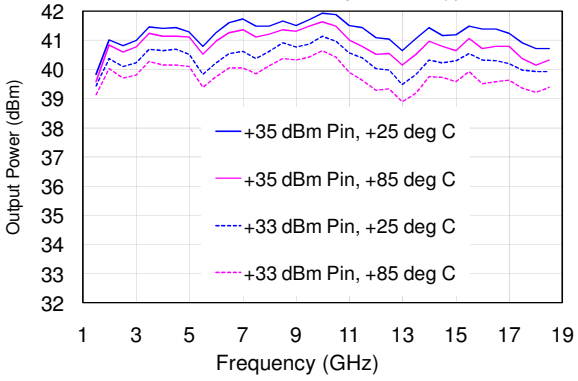



Vd = 35 V

Output Power vs. Freq. vs. Input Power
Vd = 35 V, Id = 0.5 A, Vg = -3.4 V Typical, +25°C



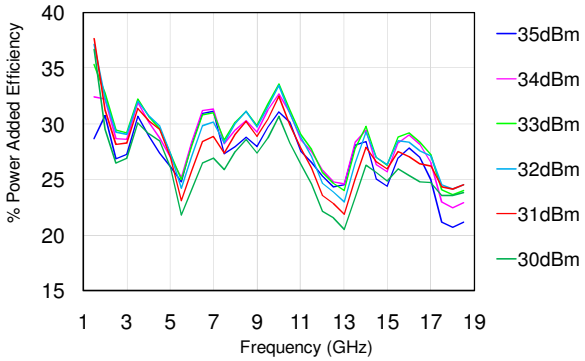

Output Power vs. Freq. vs. Temp.
Vd = 35 V, Id = 0.5 A, Vg = -3.4 V Typical



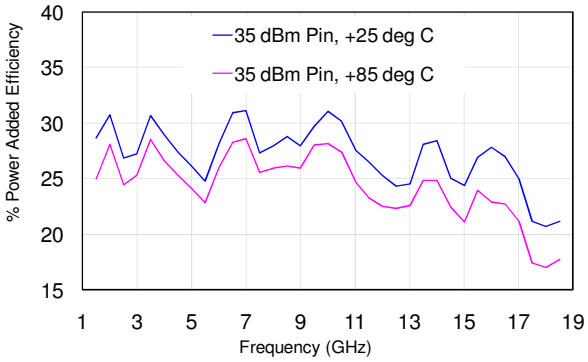
## Typical Performance (cont.)

Vd = 25 V

PAE vs. Freq. vs. Input Power
Vd = 25 V, Idq = 0.5 A, Vg = -3.4 V Typical, +25°C

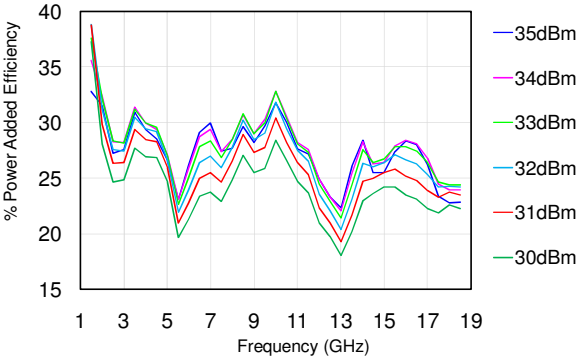



PAE vs. Freq. vs. Temp.
Vd = 25 V, Idq = 0.5 A, Vg = -3.4 V Typical

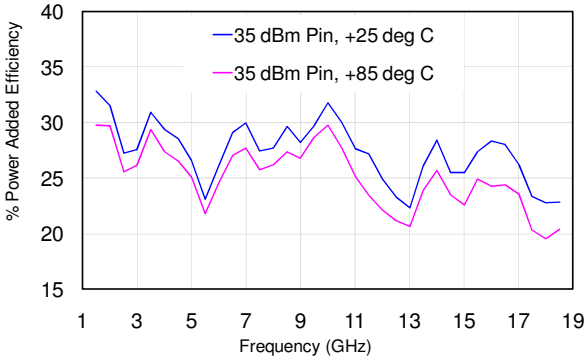



Vd = 30 V

PAE vs. Freq. vs. Input Power
Vd = 30 V, Idq = 0.5 A, Vg = -3.4 V Typical, +25°C

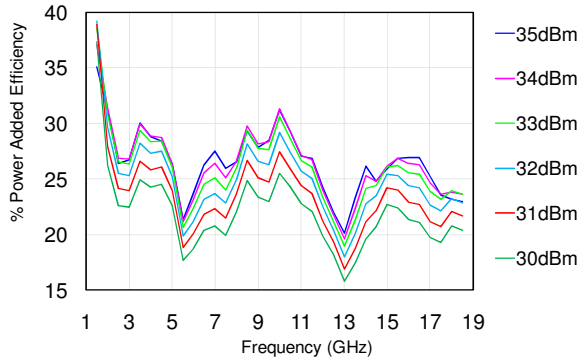



PAE vs. Freq. vs. Temp.
Vd = 30 V, Idq = 0.5 A, Vg = -3.4 V Typical

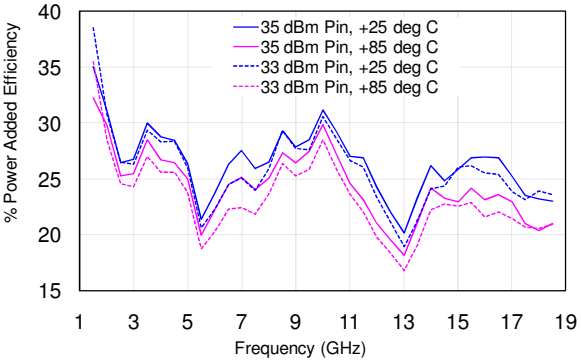



Vd = 35 V

PAE vs. Freq. vs. Input Power
Vd = 35 V, Idq = 0.5 A, Vg = -3.4 V Typical, +25°C

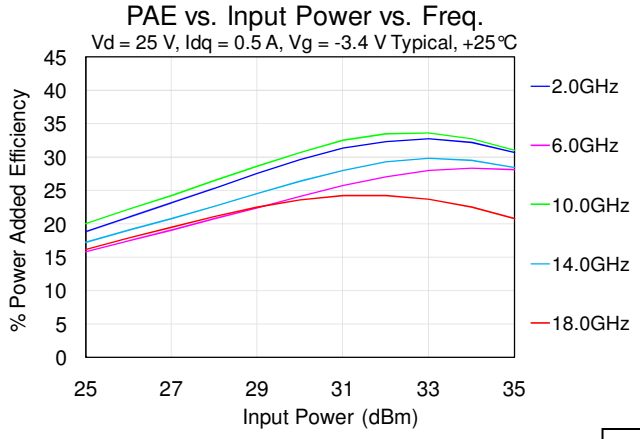


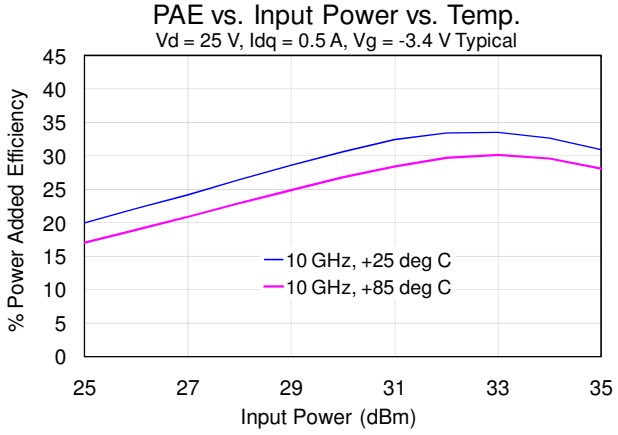

PAE vs. Freq. vs. Temp.
Vd = 35 V, Idq = 0.5 A, Vg = -3.4 V Typical



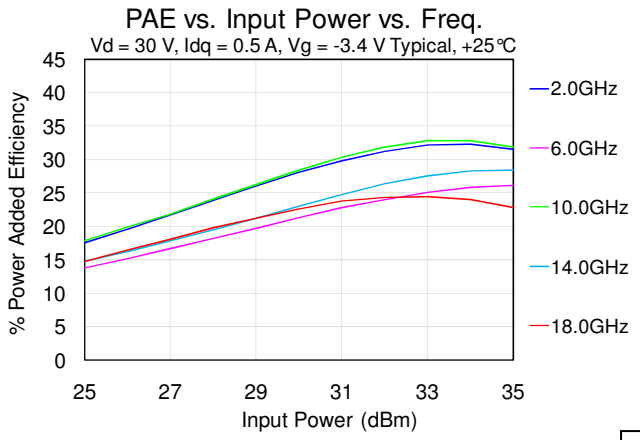
## Typical Performance (cont.)

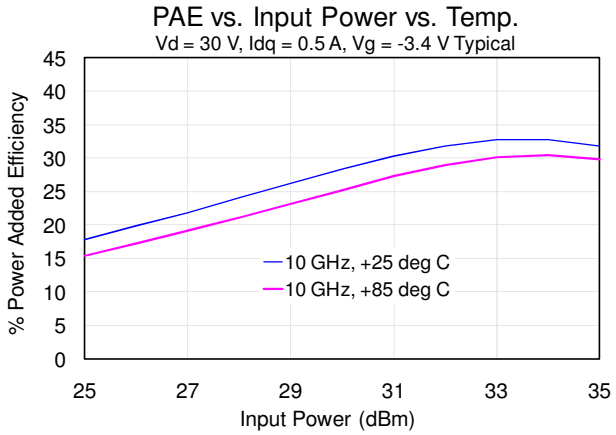
Vd = 25 V



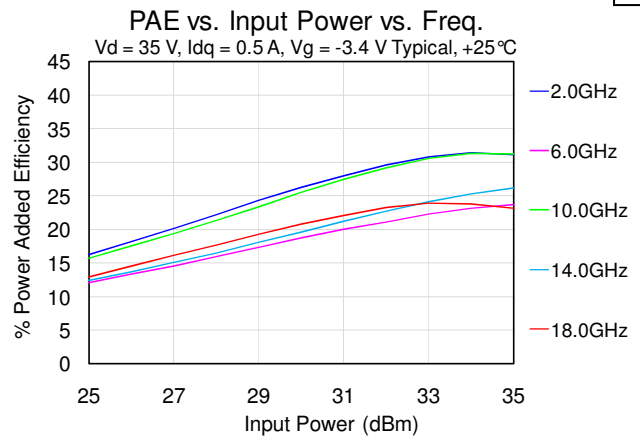



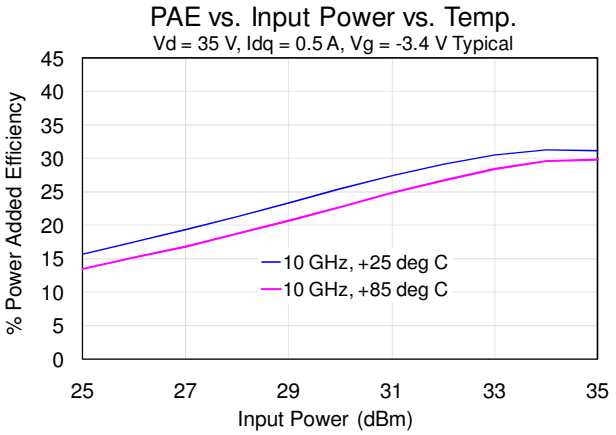

Vd = 30 V



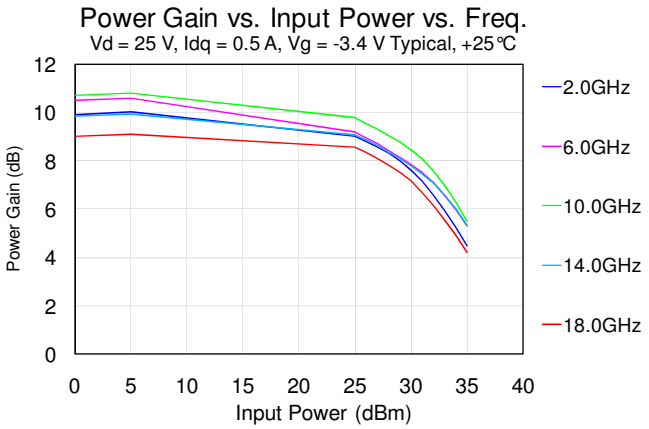

Vd = 35 V

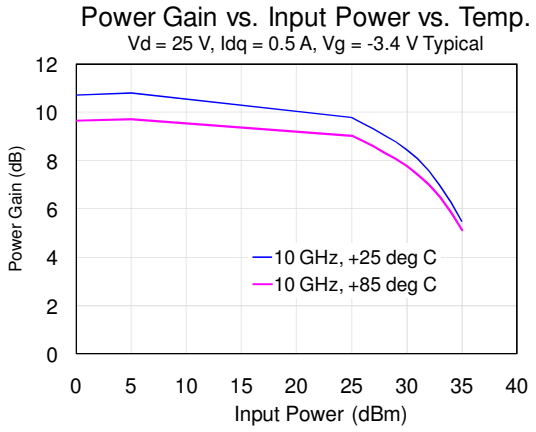


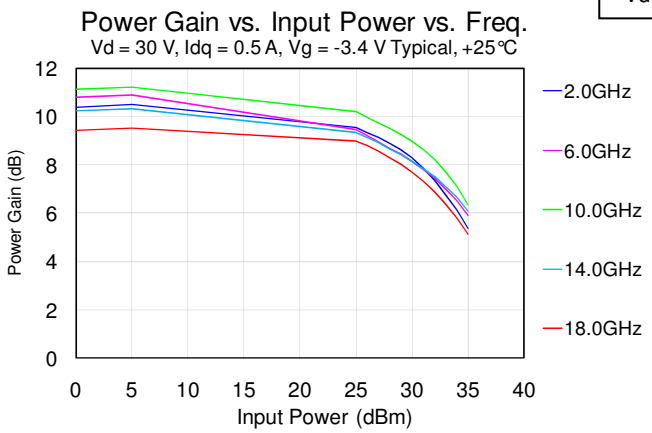
## Typical Performance (cont.)

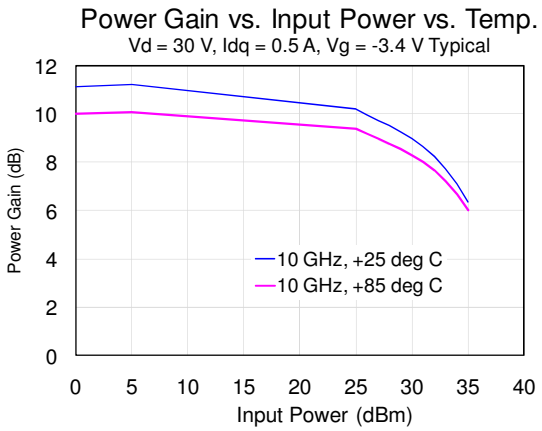
Vd = 25 V



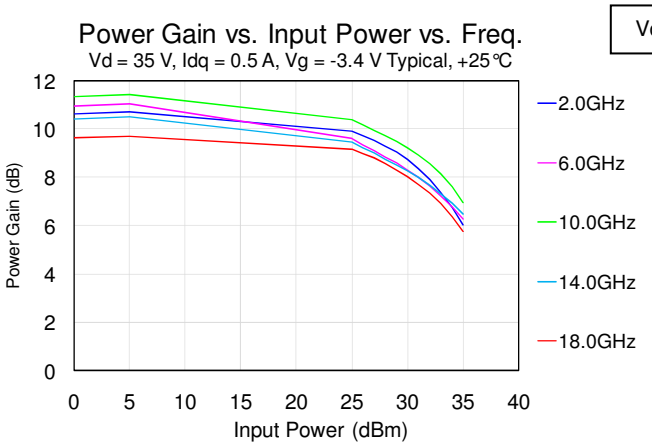



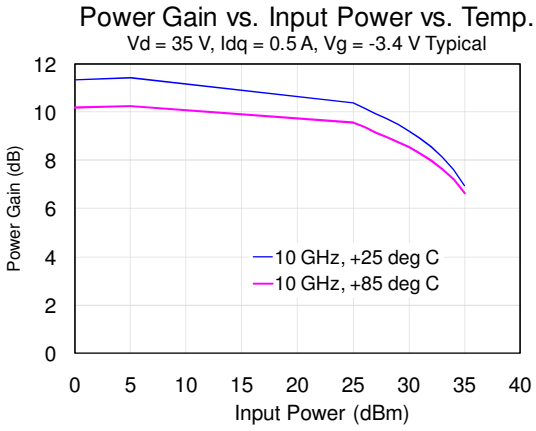

Vd = 30 V




Vd = 35 V

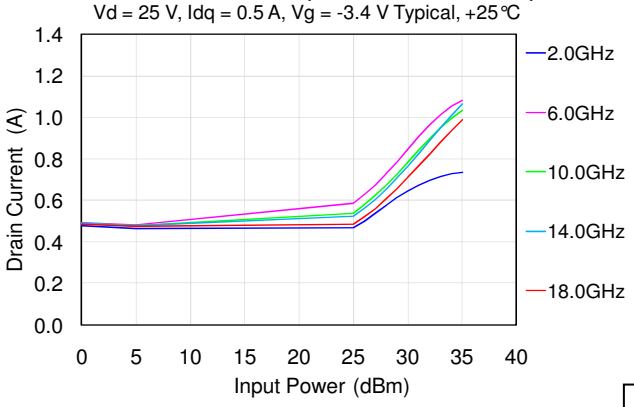


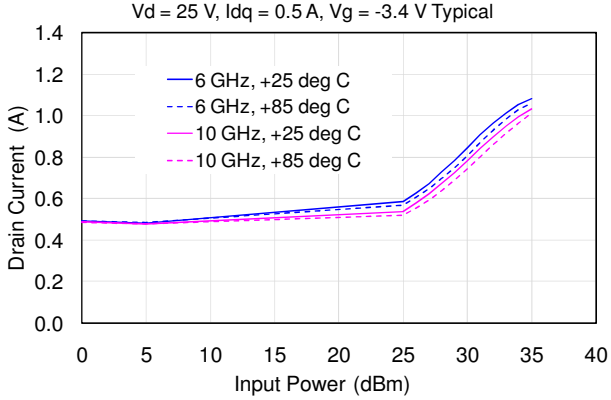
## Typical Performance (cont.)

Vd = 25 V

Drain Current vs. Input Power vs. Freq.
Vd = 25 V, Idq = 0.5 A, Vg = -3.4 V Typical, +25°C

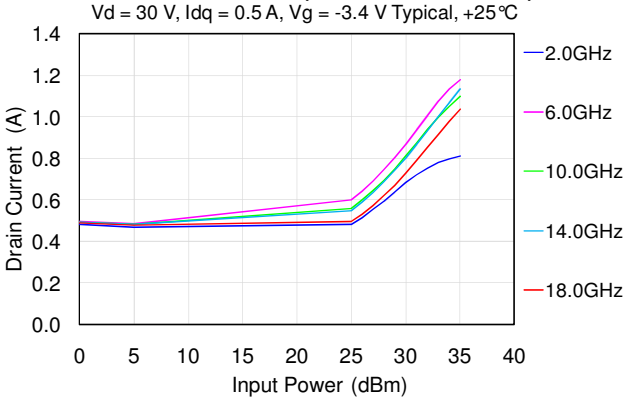



Drain Current vs. Input Power vs. Temp.
Vd = 25 V, Idq = 0.5 A, Vg = -3.4 V Typical

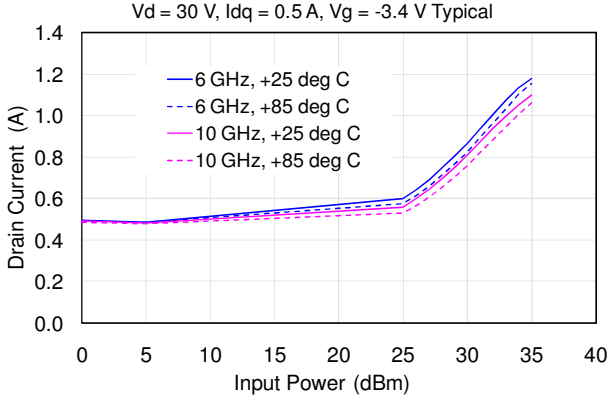



Vd = 30 V

Drain Current vs. Input Power vs. Freq.
Vd = 30 V, Idq = 0.5 A, Vg = -3.4 V Typical, +25°C

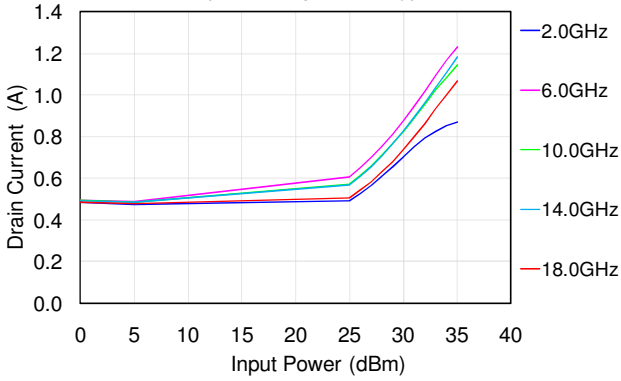



Drain Current vs. Input Power vs. Temp.
Vd = 30 V, Idq = 0.5 A, Vg = -3.4 V Typical

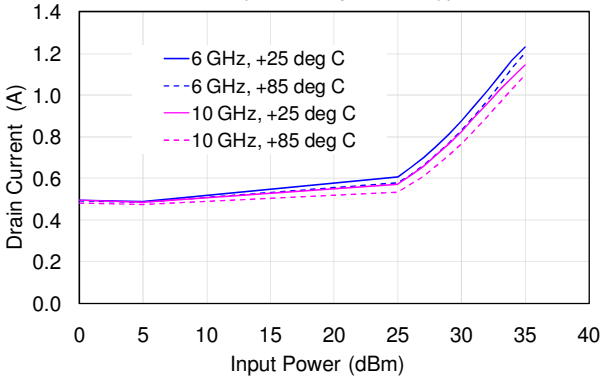



Vd = 35 V

Drain Current vs. Input Power vs. Freq.
Vd = 35 V, Idq = 0.5 A, Vg = -3.4 V Typical, +25°C



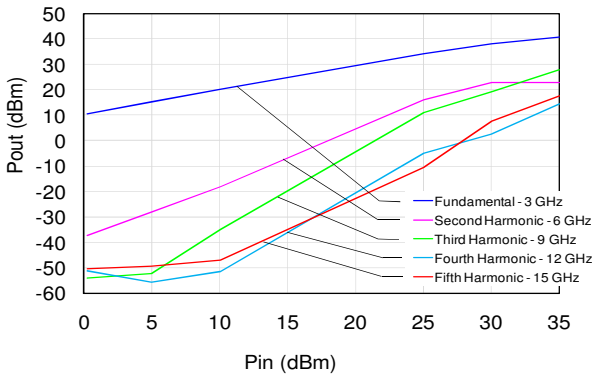

Drain Current vs. Input Power vs. Temp.
Vd = 35 V, Idq = 0.5 A, Vg = -3.4 V Typical



## Typical Performance (cont.)

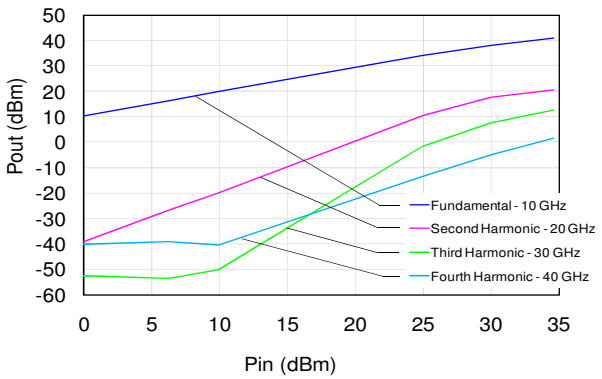
Vd = 35 V

3 GHz Harmonics vs. Input Power vs. Freq.
Vd = 35 V, Idq = 0.5 A, Vg = -3.4 V Typical, +85°C



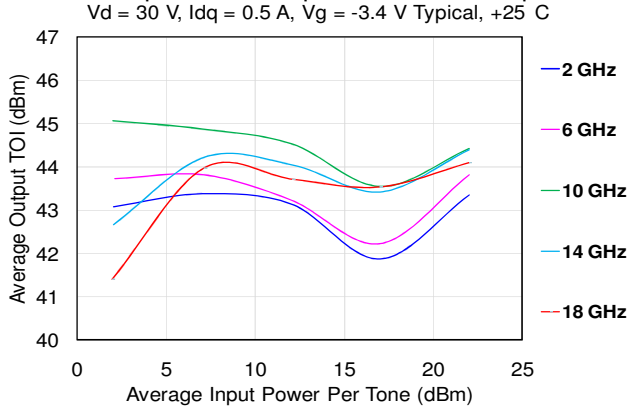

Vd = 35 V

10 GHz Harmonics vs. Input Power vs. Freq.
Vd = 35 V, Idq = 0.5 A, Vg = -3.4 V Typical, +85°C



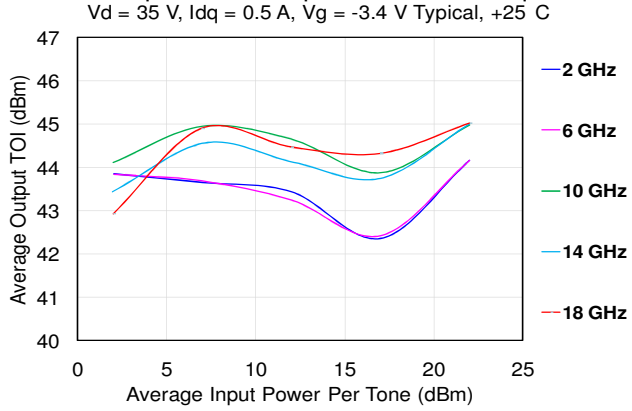

Vd = 30 V

Output TOI vs. Input Power vs. Freq.
Vd = 30 V, Idq = 0.5 A, Vg = -3.4 V Typical, +25 C

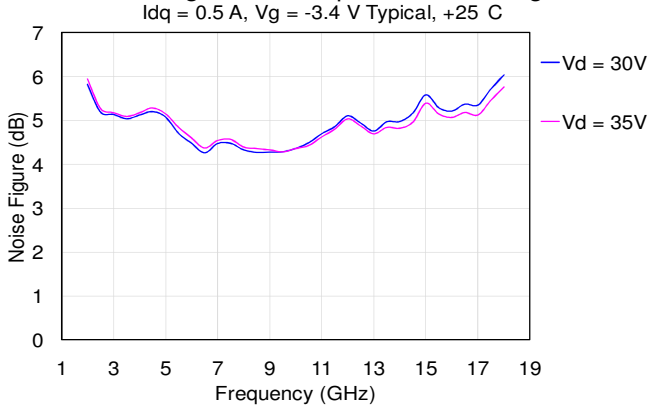



Vd = 35 V

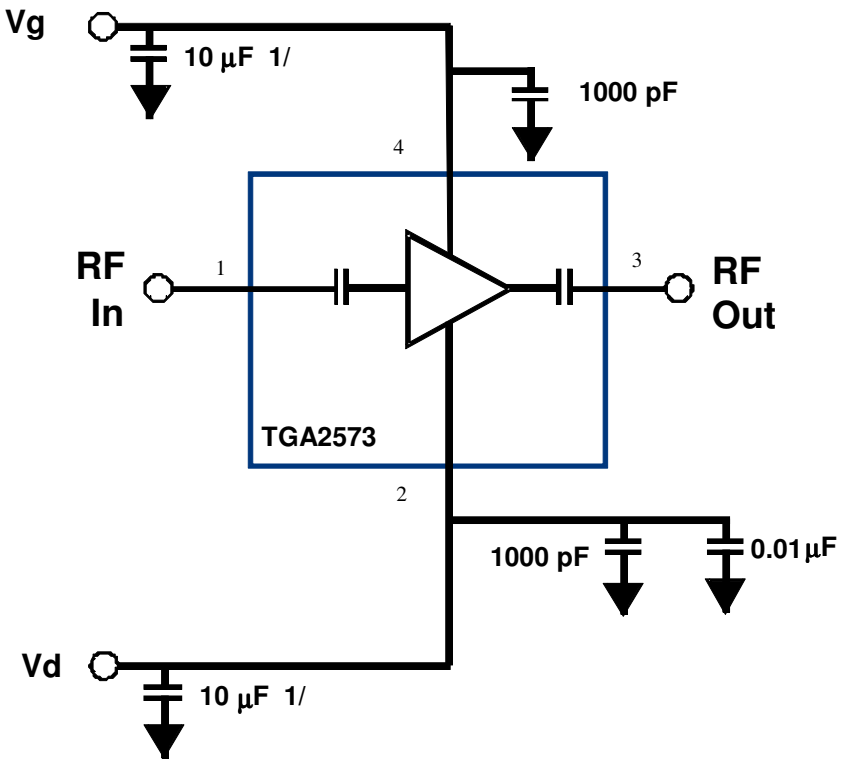
Output TOI vs. Input Power vs. Freq.
Vd = 35 V, Idq = 0.5 A, Vg = -3.4 V Typical, +25 C




Noise Figure vs. Freq. vs. Drain Voltage
Idq = 0.5 A, Vg = -3.4 V Typical, +25 C



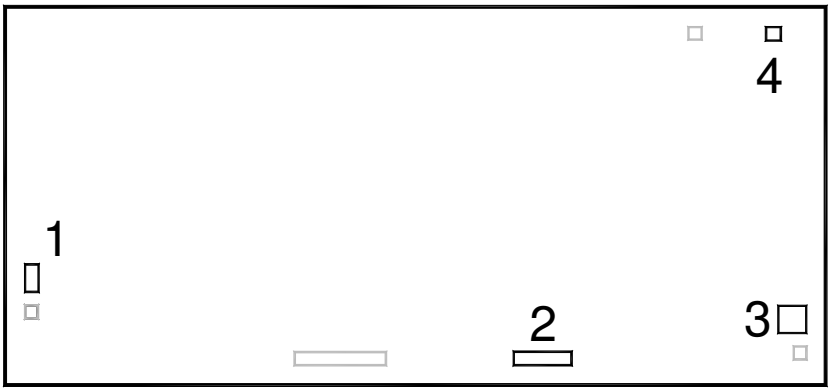
## Application Circuit




| Bias-up Procedure | Bias-down Procedure |
|---|---|
| Vg set to -6.0 V | Turn off RF signal |
| Vd set to +30 V | Reduce Vg to -6.0 V. Ensure Id ~ 0 mA |
| Adjust Vg more positive until quiescent Id is 500 mA. This will be ~ Vg = -3.4 V | Set Vd to 0 V |
| Apply RF signal to RF Input | Set Vg to 0 V |

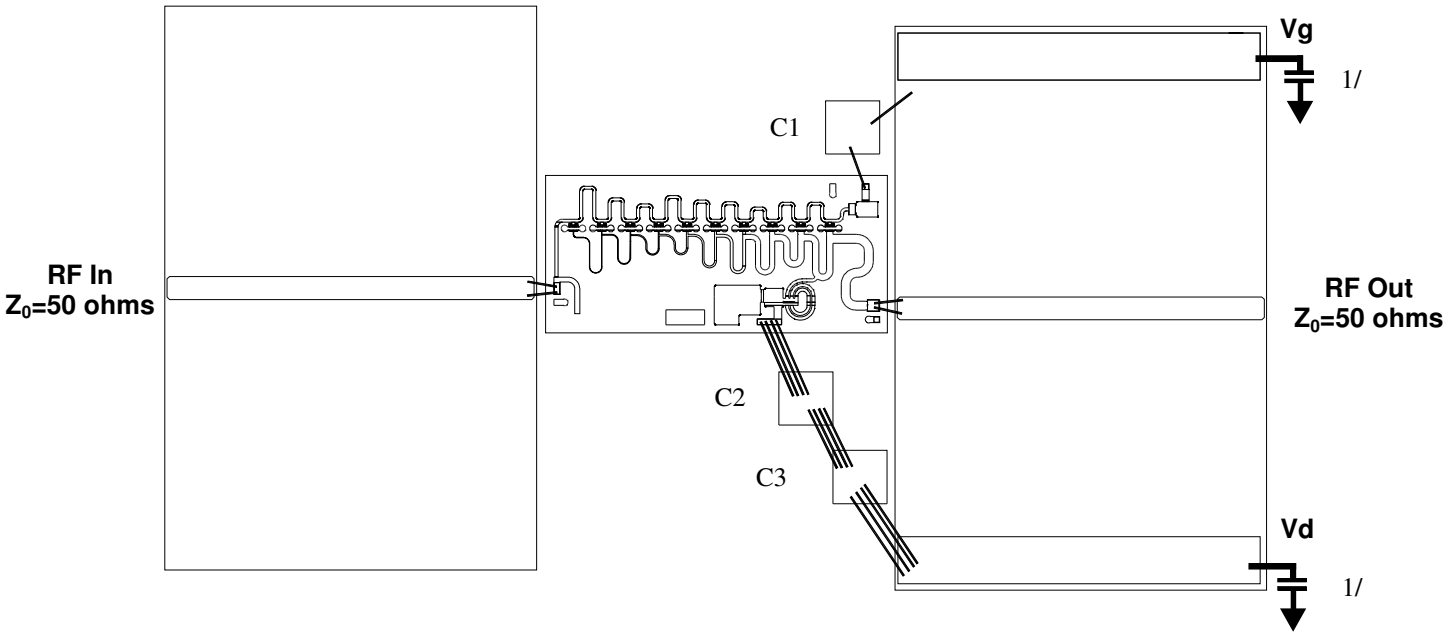
1/ Additional bypass capacitors may be required at this location. The value of these capacitors varies by application. Variables include power supply impedance, power supply stability with reactive loads, and the inductance from the power supply to this assembly. One to 47 uF tantalum capacitors are commonly used here.

## Bond Pad Description




| Bond Pad | Symbol | Description |
|---|---|---|
| 1 | RF In | Input, matched to 50 ohms |
| 2 | Vd | Drain voltage |
| 3 | RF Out | Output, matched to 50 ohms |
| 4 | Vg | Gate voltage |
| | GND | Backside of die |

## Assembly Drawing

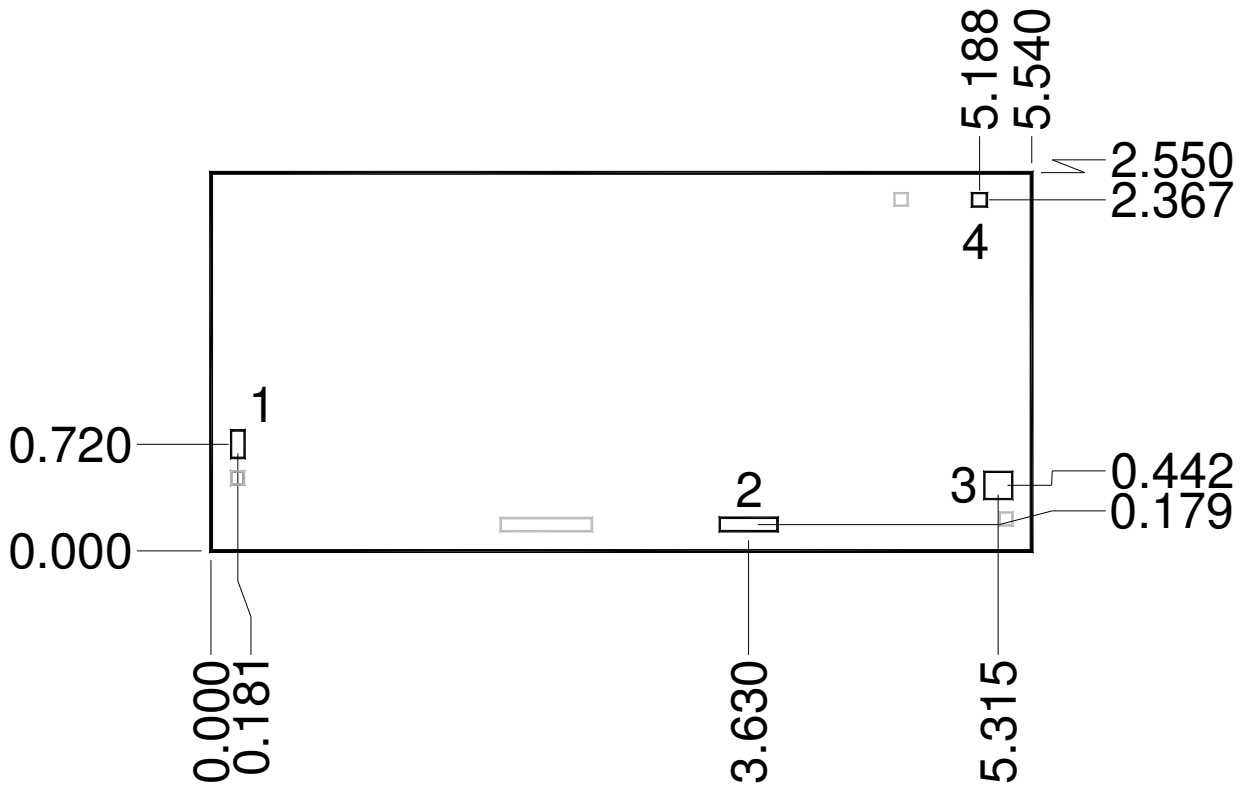



## Bill of Material

| Ref Des | Value | Description | Manufacturer | Part Number |
|---|---|---|---|---|
| C1, C2 | 1000 pF | Cap, 50V, 10%, Single Layer | various | |
| C3 | 0.01 uF | Cap, 50V, 10%, SMD | various | |

1/ See 'Application Circuit' Note 1

## Mechanical Information




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 |
|---|---|---|
| 1 | RF In | 0.100 x 0.195 |
| 2 | Vd | 0.400 x 0.100 |
| 3 | RF Out | 0.200 x 0.195 |
| 4 | Vg | 0.110 x 0.100 |

## Product Compliance Information

### ESD Information

**Caution! ESD-Sensitive Device**

| | |
|---|---|
| ESD Rating: | TBD |
| Value: | TBD |
| Test: | Human Body Model (HBM) |
| Standard: | JEDEC Standard JESD22-A114 |

### ECCN

US Department of State XI(c)

### Solderability

This part is compliant with EU 2002/95/EC RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free

## 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.
- 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.
- Do not use any kind of flux.
- Coefficient of thermal expansion matching is critical for long-term reliability.
- In order to achieve the advertised performance and to maintain reliability of the product, it is necessary for the solder attach to cover >90% for each of the active areas. An active area is defined as a single unit cell. This is critical given the high power dissipation associated with GaN power amplifiers. Total die area should not exceed 10% voiding.
- Devices must be stored in a dry nitrogen atmosphere.

Interconnect process assembly notes:

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

## Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations, and information about TriQuint:

**Web:** www.triquint.com **Tel:** +1.972.994.8465
**Email:** info-sales@tqs.com **Fax:** +1.972.994.8504

For technical questions and application information:

**Email:** info-products@tqs.com

## Important Notice

The information contained herein is believed to be reliable. TriQuint makes no warranties regarding the information contained herein. TriQuint assumes no responsibility or liability whatsoever for any of the information contained herein. TriQuint assumes no responsibility or liability whatsoever for the use of the information contained herein. The information contained herein is provided "AS IS, WHERE IS" and with all faults, and the entire risk associated with such information is entirely with the user. All information contained herein is subject to change without notice. Customers should obtain and verify the latest relevant information before placing orders for TriQuint products. The information contained herein or any use of such information does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other intellectual property rights, whether with regard to such information itself or anything described by such information.

TriQuint products are not warranted or authorized for use as critical components in medical, life-saving, or life-sustaining applications, or other applications where a failure would reasonably be expected to cause severe personal injury or death.