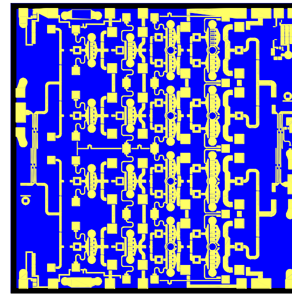
# TGA4543

*40.5 - 43.5 GHz Power Amplifier*

TriQuint SEMICONDUCTOR®

## Applications

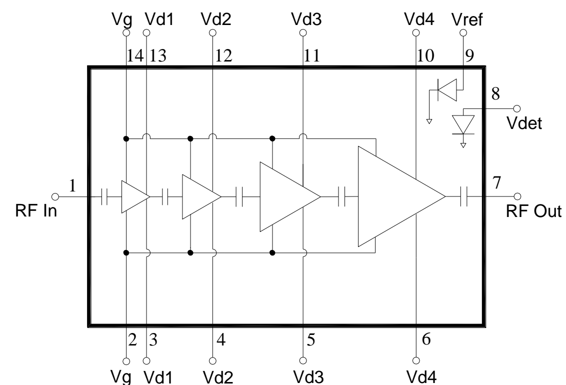
- Point to Point Radio
- Millimeter-wave Communications
- Military & Space



## Product Features

- Frequency range: 40.5 - 43.5 GHz
- Output Power: 30 dBm Psat, 28.5 dBm P1dB
- Gain: 23 dBm Typical
- TOI: 38 dBm @ 18 dBm Output/Tone
- Integrated Power Detector
- Bias: Vcc = 6V, Icc = 900 mA Typical
- Dimension: 2.95 x 2.95 x 0.1 mm

## Functional Block Diagram




## General Description

The TriQuint TGA4543 is a 40.5 - 43.5 GHz Power Amplifier designed using TriQuint's power pHEMT production process.

The TGA4543 typically provides 28.5 dBm of output power at 1dB gain compression with small signal gain of 23 dB. Third Order Intercept is 38 dBm at 18 dBm Output/Tone.

The TGA4543 is ideally suited for Point-to-Point Radio, Ka-band communications, and Millimeter-wave communications.

Lead-free and RoHS compliant.

Evaluation Boards are available upon request.

## Bond Pad Configuration

| Bond Pad # | Function Label |
|---|---|
| 1 | RF In |
| 2, 14 | Vg |
| 3, 4, 5, 6, 10, 11, 12, 13 | Vd |
| 7 | RF Out |
| 8 | Vdet |
| 9 | Vref |

## Ordering Information

| Part No. | ECCN | Description |
|---|---|---|
| TGA4543 | 3A001.b.2.e | 40.5 – 43.5 GHz Power Amplifier |

Standard order qty = 50 pieces.



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## Specifications

### Absolute Maximum Ratings

| Parameter | Rating |
|---|---|
| Drain to Gate Voltage, Vd - Vg | 10V |
| Drain Voltage, Vd | +6.5 V |
| Gate Voltage, Vg | -4 to 0 V |
| Drain Current, Id | 2086 mA |
| Gate Current, Ig | -8.2 to 113 mA |
| Power Dissipation, Pdiss | 13.6 W |
| RF Input Power, CW, 50Ω, T=25°C | 26 dBm |
| Channel Temperature, Tch | 200°C |
| Mounting Temperature (30 Seconds) | 320°C |
| Storage Temperature | -40 to 150°C |

Operation of this device outside the parameter ranges given above may cause permanent damage.

### Recommended Operating Conditions

| Parameter | Min | Typ | Max | Units |
|---|---|---|---|---|
| Operating Temp. Range | -40 | +25 | +85 | °C |
| Vd | | 6.0 | | V |
| Id | | 900 | | mA |
| Id (Under RF Drive) | | 1500 | | mA |
| Vg | | -0.7 | | V |

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 ºC, Vd = 6 V, Id= 900mA, Vg = -0.7 V Typical.

| Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| Operational Frequency Range | | 40.5 | | 43.5 | GHz |
| Gain | | | 23 | | dB |
| Input Return Loss | | | 8 | | dB |
| Output Return Loss | | | 10 | | dB |
| Output Power | Saturation | | 30 | | dBm |
| Output Power | 1dB Gain Compression | | 28.5 | | dBm |
| Output TOI | 18 dBm Output/Tone | | 38 | | dBm |
| Gain Temperature Coefficient | | | -0.04 | | dB/°C |
| Power Temperature Coefficient | 1dB Gain Compression | | -0.023 | | dB/°C |


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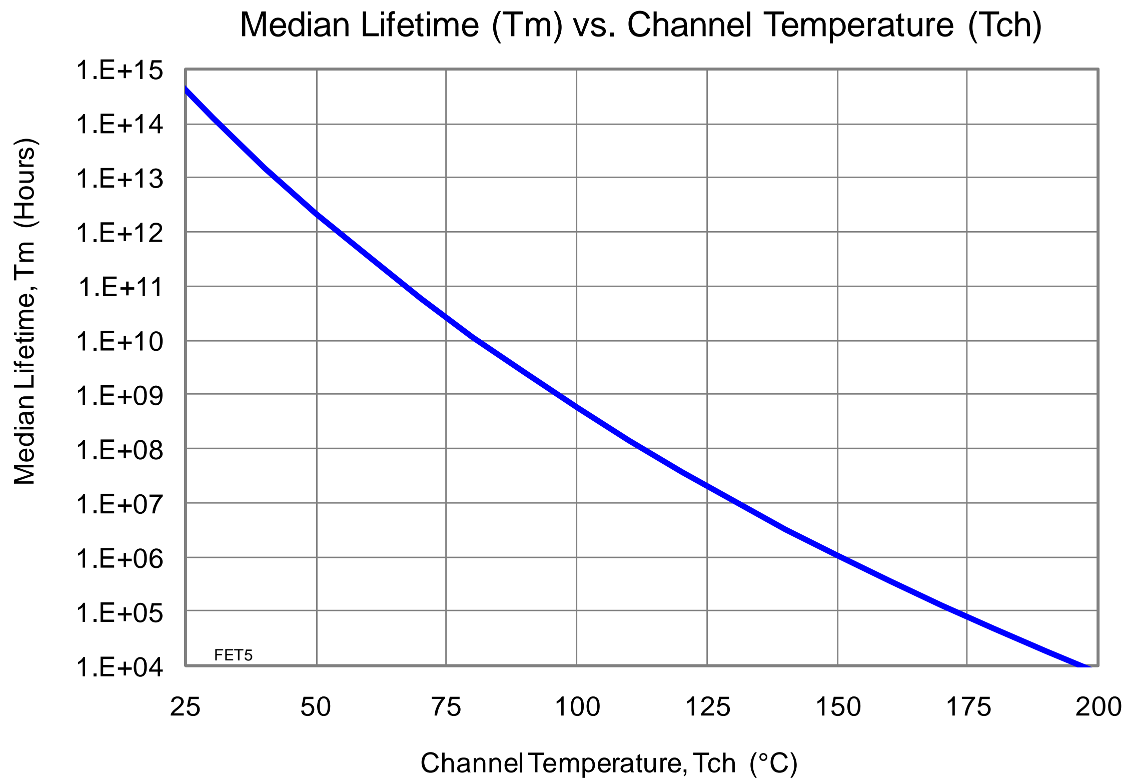
## Specifications

### Thermal and Reliability Information

| Parameter | Condition | Rating |
|---|---|---|
| Thermal Resistance, $\theta_{JC}$, measured to back of package,<br>Small-Signal<br>Under RF Drive | Tbase = 70 °C | <br><br>$\theta_{JC}$ = 7.6 °C/W<br>$\theta_{JC}$ = 10.4 °C/W |
| Channel Temperature (Tch), and Median Lifetime (Tm) | Tbase = 70 °C, Vd = 6 V, Id = 900 mA, Pdiss = 5.4 W | Tch = 111 °C<br>Tm = 2.2E+7 Hours |
| Channel Temperature (Tch), and Median Lifetime (Tm) Under RF Drive | Tbase = 70 °C, Vd = 6 V, Id = 1500 mA, Pout = 30.5 dBm, Pdiss = 7.9 W | Tch = 152 °C<br>Tm = 8.3 E+5 Hours |

Note: Thermal model includes 38um AuSn bondline and 500um CuMo thermal spreader



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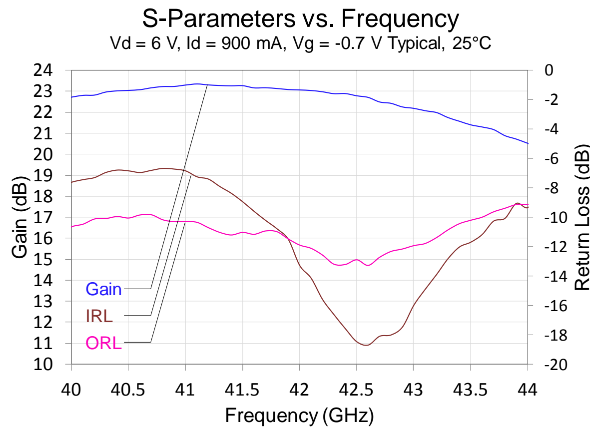
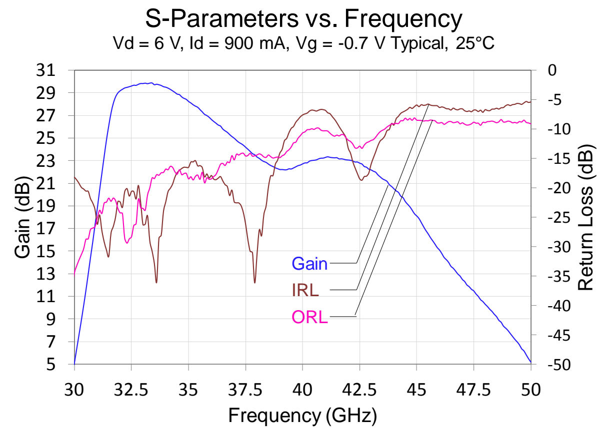
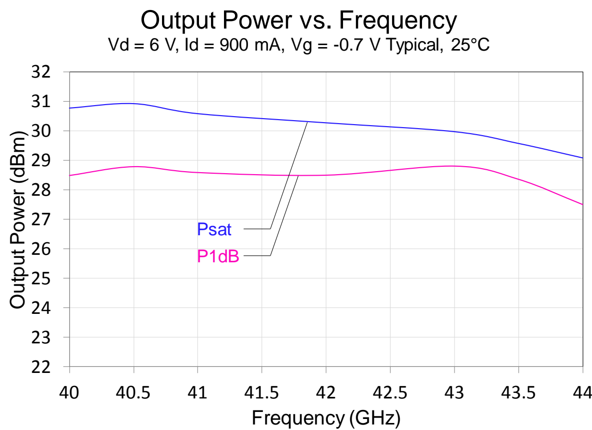
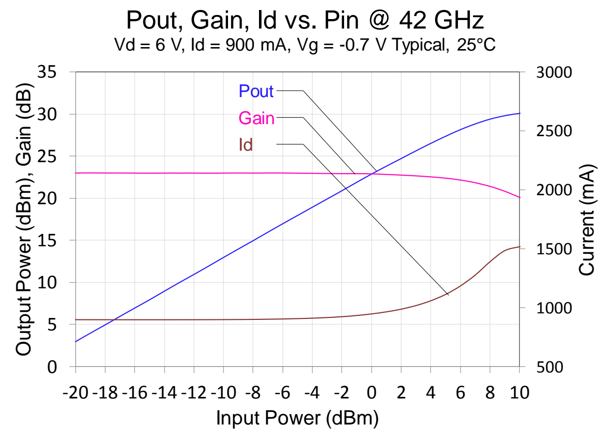
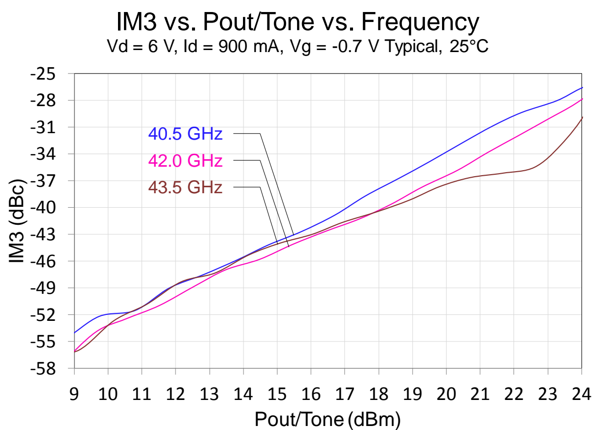
## Typical Performance

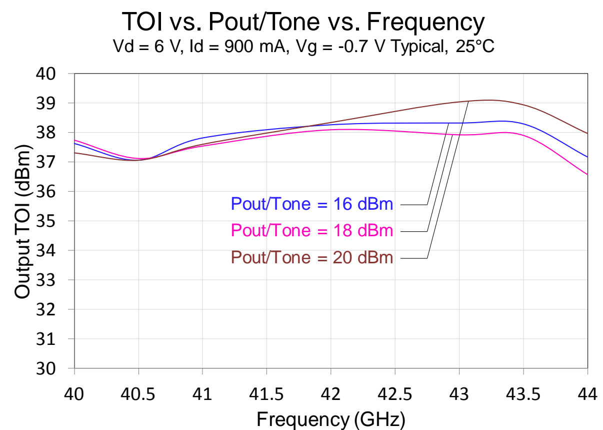


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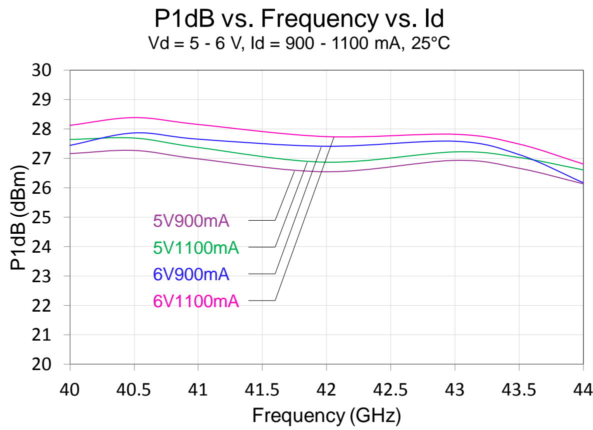
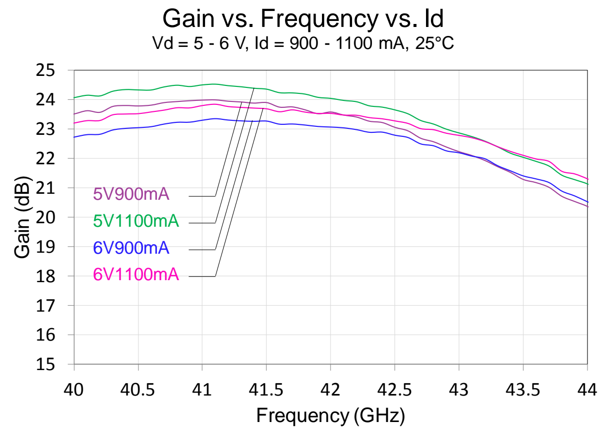
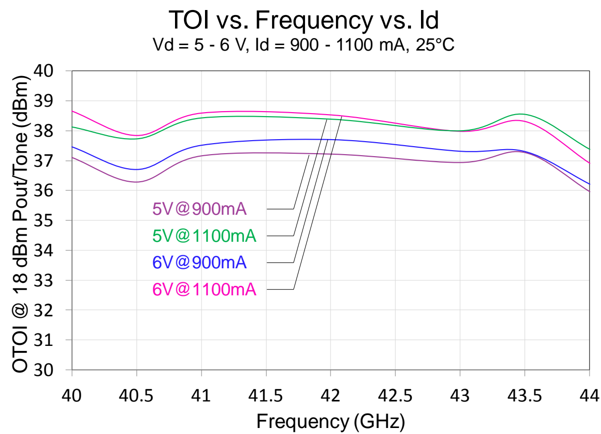
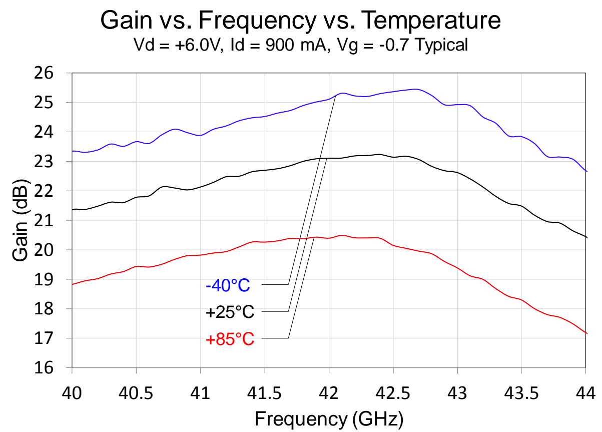
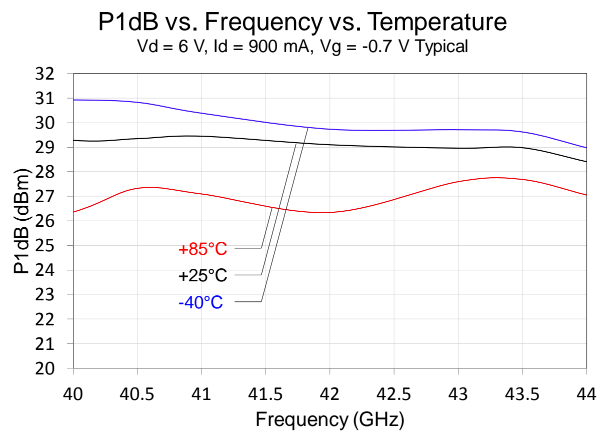
## Typical Performance

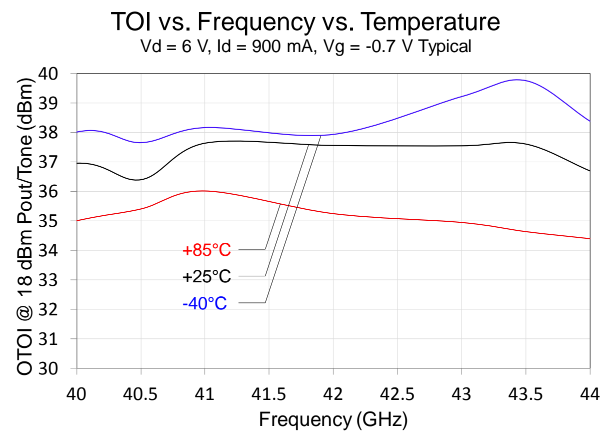


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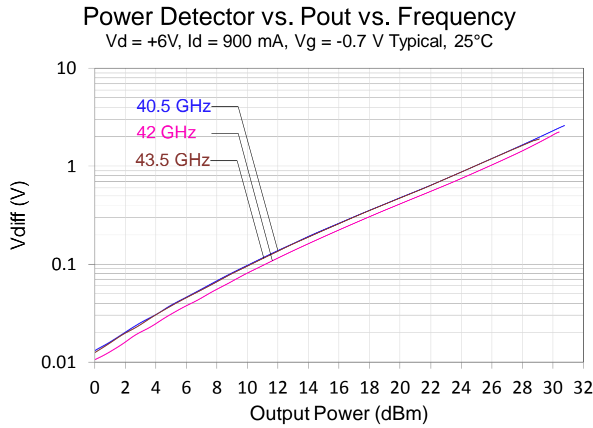
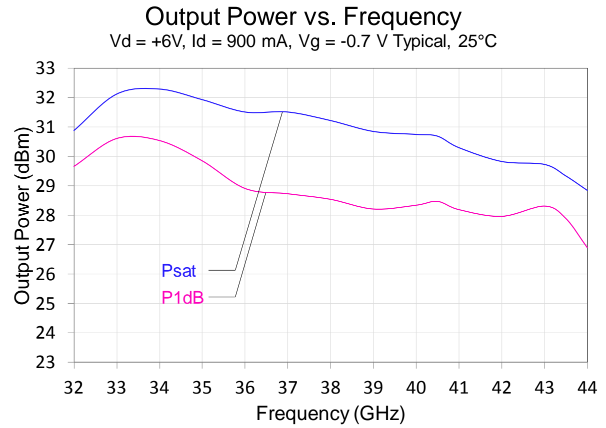
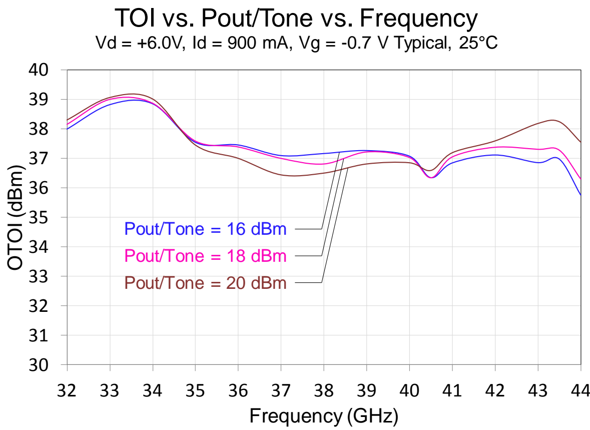
## Typical Performance



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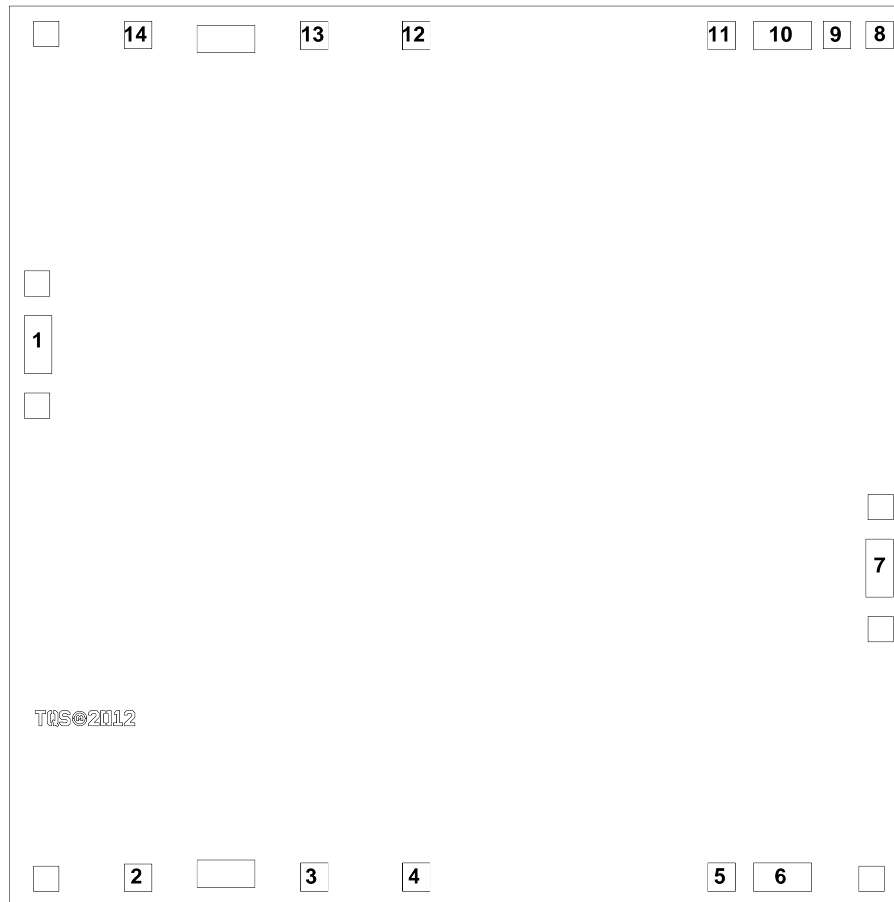
## Bond Pad Description




| Bond Pad | Symbol | Description |
|---|---|---|
| 1 | RF In | Input, matched to 50 ohms |
| 2, 14 | Vg | Gate voltage. ESD protection included; Bias network is required; see Application Circuit on page 7 as an example. |
| 3, 4, 5, 6, 10, 11, 12, 13 | Vd | Drain voltage. Bias network is required; must be biased from both sides; see Application Circuit on page 7 as an example. |
| 7 | RF Out | Output, matched to 50 ohms. |
| 8 | Vdet | Detector diode output voltage. Varies with RF output power. |
| 9 | Vref | Reference diode output voltage. |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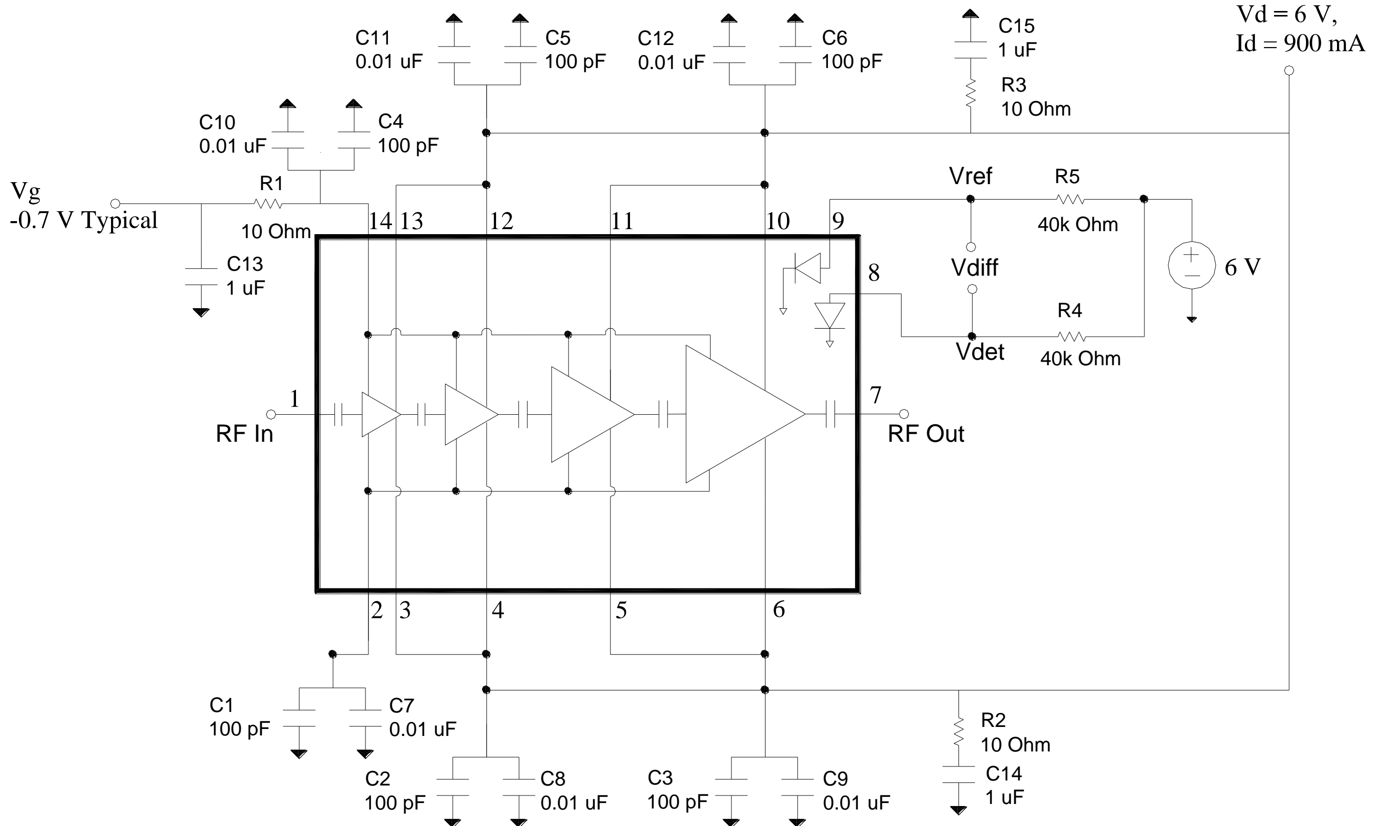
## Application Circuit




Vd must be biased from both sides. Vg can be biased from either side.

| Bias-up Procedure | Bias-down Procedure |
|---|---|
| Vg set to -1.5 V | Turn off RF supply |
| Vd set to +6 V | Reduce Vg to -1.5V. Ensure Id ~ 0 mA |
| Adjust Vg more positive until quiescent Id is 900 mA. This will be ~ Vg = -0.7 V | Turn Vd to 0 V |
| Apply RF signal to RF Input | Turn Vg to 0 V |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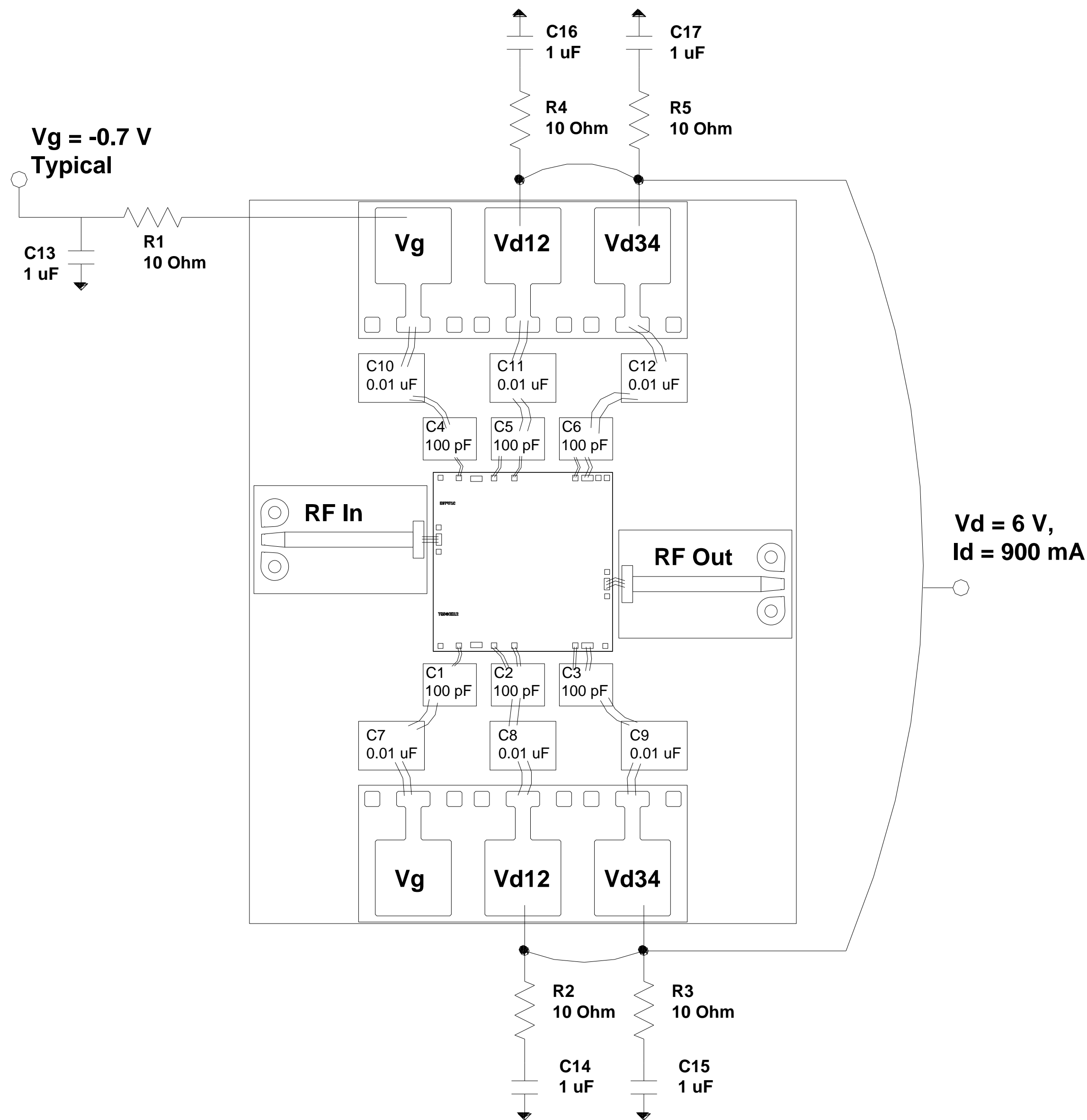
## Application Circuit




## Bill of Material

| Ref Des | Value | Description | Manufacturer | Part Number |
|---|---|---|---|---|
| C1, C2, C3, C4, C5, C6 | 100 pF | Cap, 50V, 10%, Single Layer Cap | various | |
| C7, C8, C9, C10, C11, C12 | 0.01 µF | Cap, 50V, 10%, SMD | various | |



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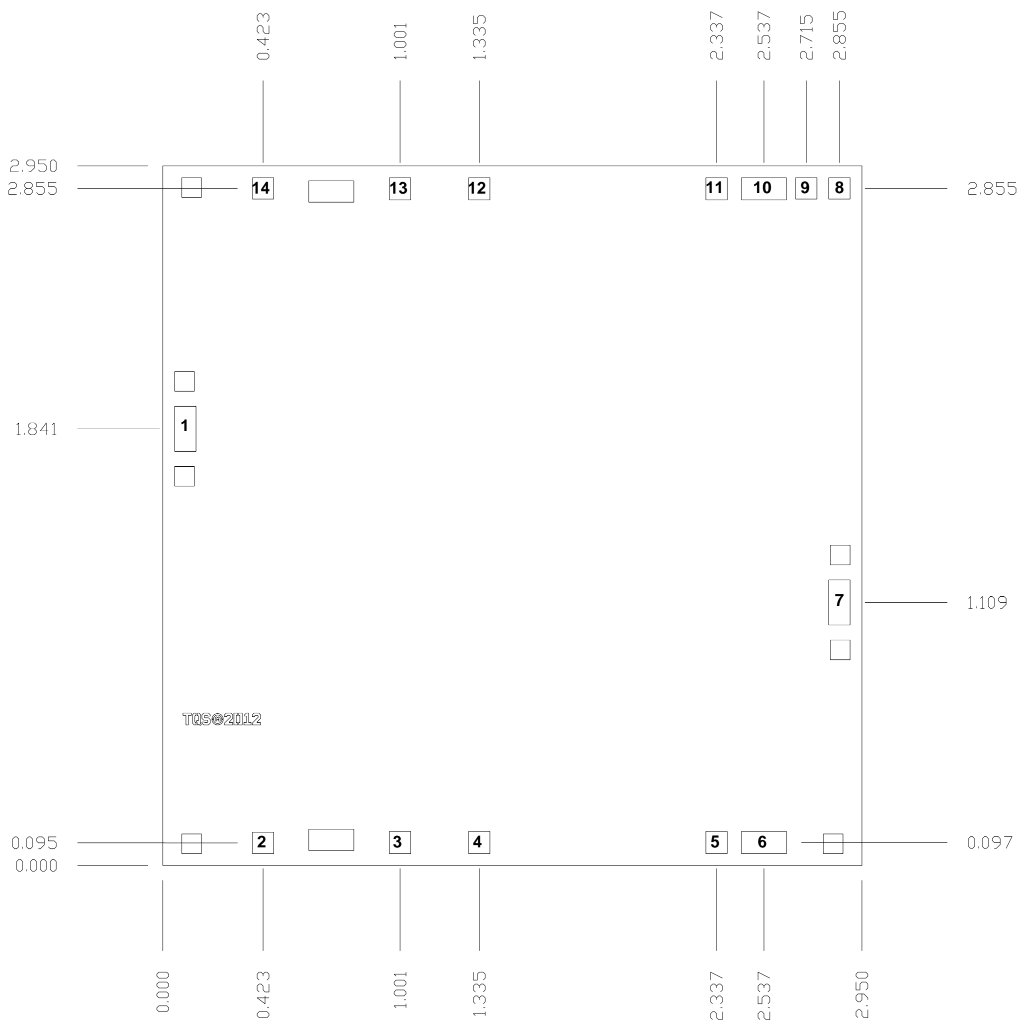
## Mechanical Information




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 | 0.190 x 0.090 |
| 2, 14 | Vg | 0.090 x 0.090 |
| 3, 4, 5, 11, 12, 13 | Vd | 0.093 x 0.090 |
| 6, 10 | Vd | 0.093 x 0.190 |
| 7 | RF Out | 0.190 x 0.090 |
| 8 | Vdet | 0.090 x 0.090 |
| 9 | Vref | 0.090 x 0.090 |



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## Product Compliance Information

### ESD Information

**Caution! ESD-Sensitive Device**

ESD Rating: Class 0
Value: Passes 150V
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

### Solderability

Compatible with both lead-free (260 °C max. reflow temp.) and tin/lead (245 °C max. reflow temp.) soldering processes.

### RoHS Compliance

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 ($C_{15}H_{12}Br_4 0_2$) 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.
- 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 ultrasonics are critical parameters.
- Aluminum wire should not be used.
- Devices with small pad sizes should be bonded with 0.0007-inch wire.


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