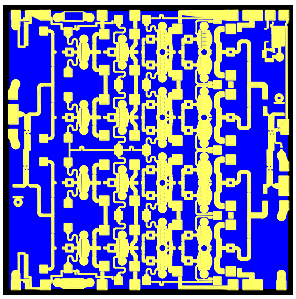
TGA4542

37 - 40 GHz 1W Power Amplifier

Applications

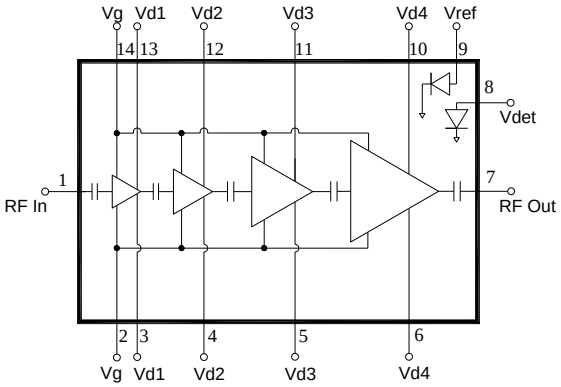
- Point to Point Radio
- Millimeter-wave Communications
- Military & Space



Product Features

- Frequency range: 37 - 40 GHz
- Output Power: 32.5 dBm Psat, 31.5 dBm P1dB
- Gain: 26 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 TGA4542 is a 37 - 40 GHz Power Amplifier designed using TriQuint's power pHEMT production process.

The TGA4542 typically provides 31.5 dBm of output power at 1dB gain compression with small signal gain of 26 dB. Third Order Intercept is 38 dBm at 18 dBm Output/Tone.

The TGA4542 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
TGA4542	3A001.b.2.e	37 - 40 GHz 1W Power Amplifier

Standard order qty = 50 pieces.

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.

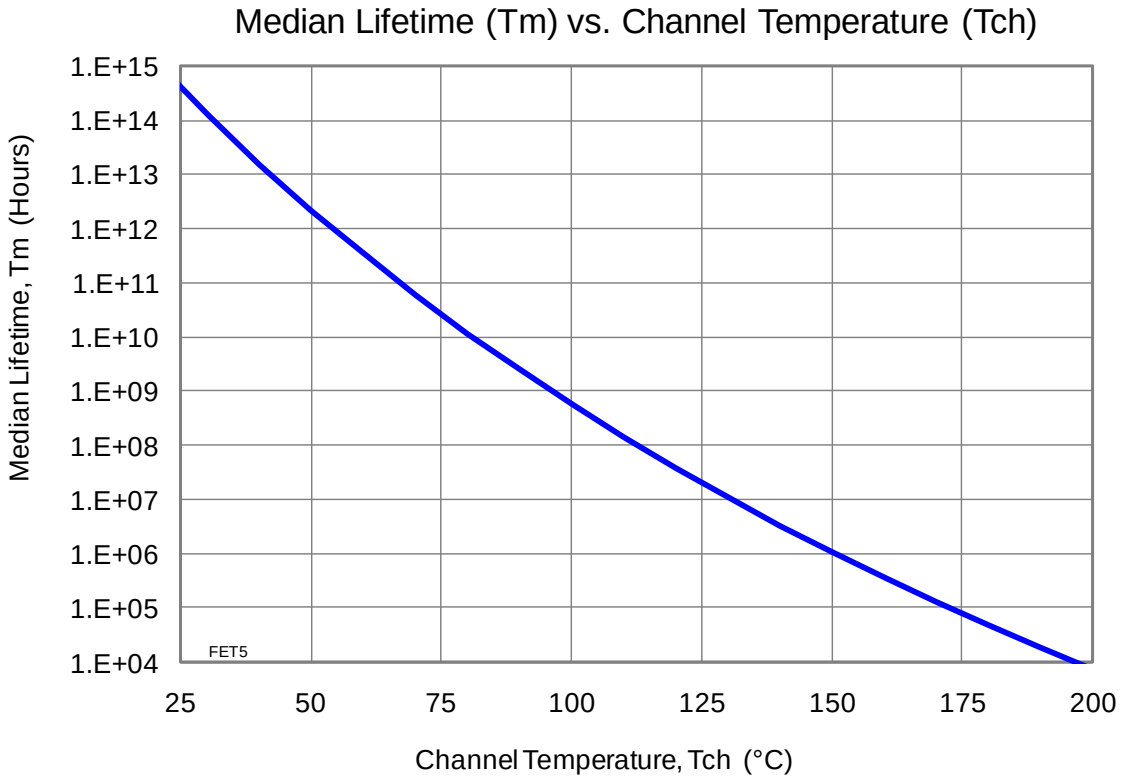
Parameter	Conditions	Min	Typ	Max	Units
Operational Frequency Range		37		40	GHz
Gain			26		dB
Input Return Loss			8		dB
Output Return Loss			15		dB
Output Power	Saturation		32.5		dBm
Output Power	1dB Gain Compression		31.5		dBm
Output TOI	18 dBm Output/Tone		38		dBm
Gain Temperature Coefficient			-0.04		dB/°C
Power Temperature Coefficient	1dB Gain Compression		-0.013		dB/°C

Specifications

Thermal and Reliability Information

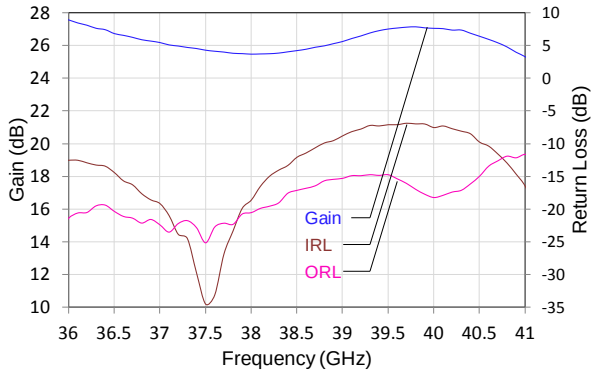
Parameter	Condition	Rating
Thermal Resistance, θ_{JC}, measured to back of thermal spreader Small-Signal Under RF Drive	Tbase = 70 °C	 θ_{JC} = 7.6 °C/W θ_{JC} = 10.4 °C/W
Channel Temperature (Tch), and Median Lifetime (Tm)	Tbase = 70 °C, Vd = 6 V, Id = 900 mA, Pdiss = 5.4 W	Tch = 111 °C Tm = 2.2E+7 Hours
Channel Temperature (Tch), and Median Lifetime (Tm) Under RF Drive	Tbase = 70 °C, Vd = 6 V, Id = 1500 mA, Pout = 32.5 dBm, Pdiss = 7.2 W	Tch = 145 °C Tm = 1.8E+6 Hours

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

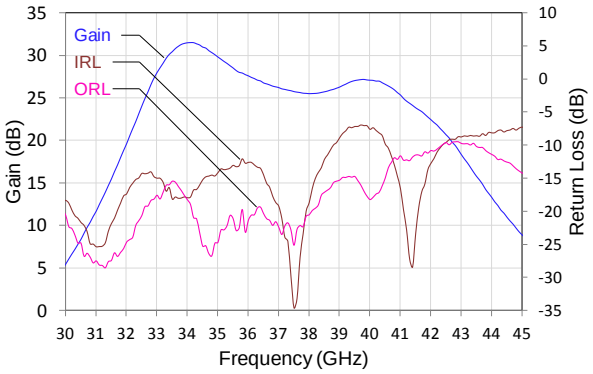


Typical Performance

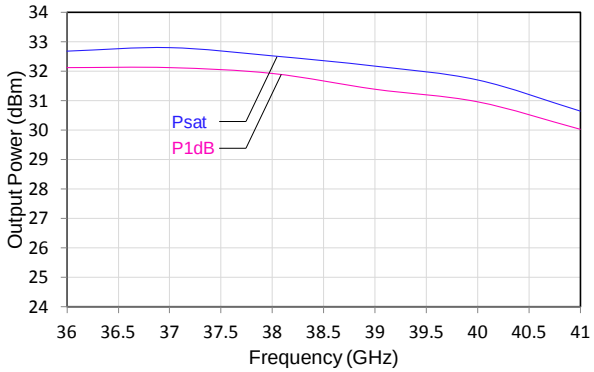
S-Parameters vs. Frequency
Vd = 6V, Id = 900mA, Vg = -0.7V Typical, +25°C



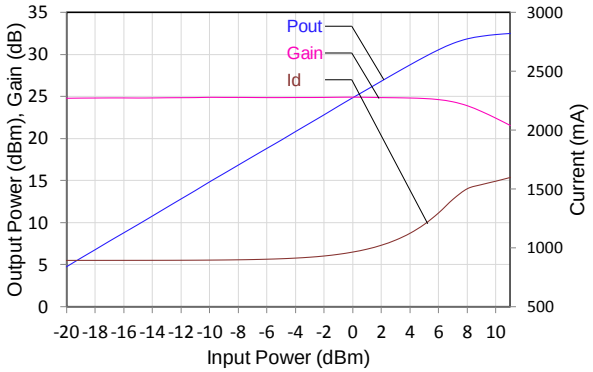
S-Parameters vs. Frequency
Vd = 6V, Id = 900mA, Vg = -0.7V Typical, +25°C



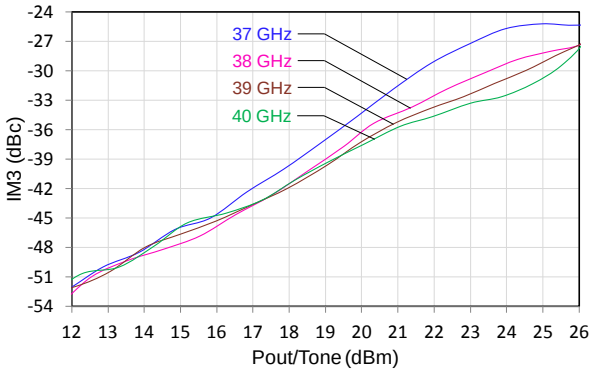
Output Power vs. Frequency
Vd = 6 V, Id = 900 mA, Vg = -0.7 V Typical, +25°C



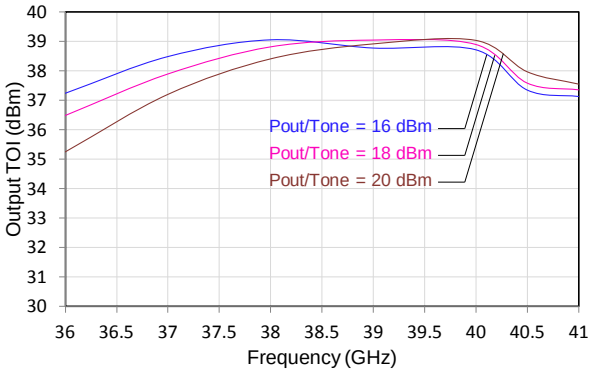
Pout, Gain, Id vs. Pin @ 38 GHz
Vd = 6 V, Id = 900 mA, Vg = -0.7 V Typical, +25°C



IM3 vs. Pout / Tone vs. Frequency
Vd = 6 V, Id = 900 mA, Vg = -0.7 V Typical, +25°C

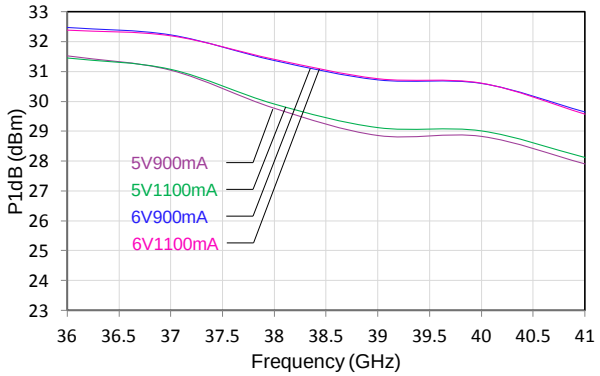


TOI vs. Pout/Tone vs. Frequency
Vd = 6 V, Id = 900 mA, Vg = -0.7 V Typical, +25°C

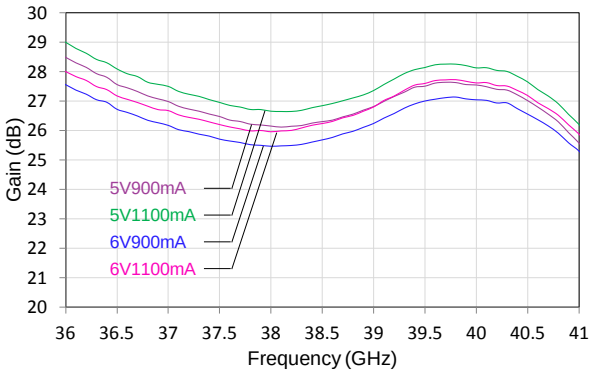


Typical Performance

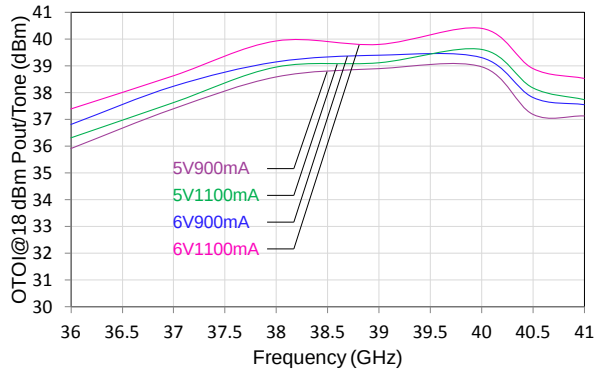
P1dB vs. Frequency vs. Id
Vd = 5 - 6 V, Id = 900 - 1100 mA, +25°C



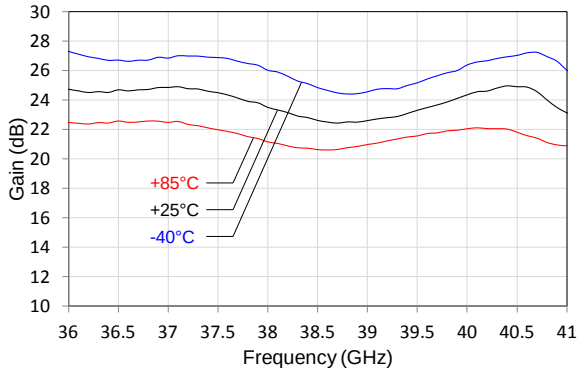
Gain vs. Frequency vs. Id
Vd = 5 - 6V, Id = 900 - 1100 mA, +25°C



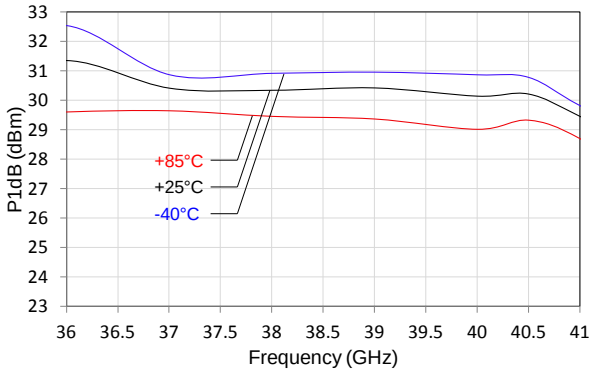
TOI vs. Frequency vs. Id
Vd = 5 - 6 V, Id = 900 - 1100 mA, +25°C



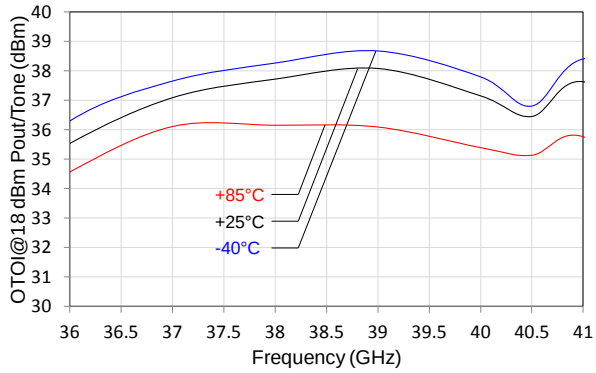
Gain vs. Frequency vs. Temperature
Vd = 6 V, Id = 900 mA, Vg = -0.7 V Typical



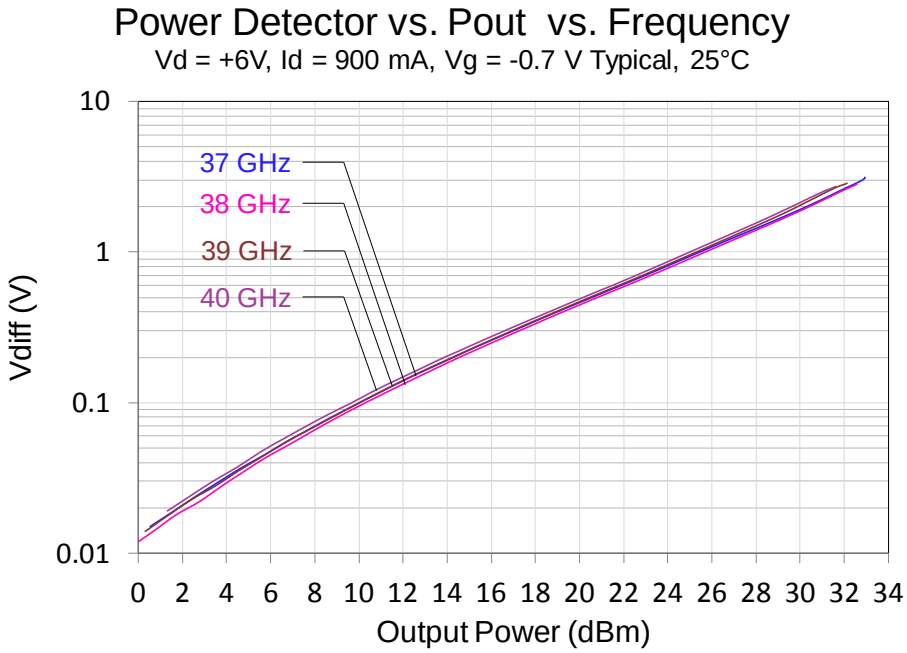
P1dB vs. Frequency vs. Temperature
Vd = 6 V, Id = 900 mA, Vg = -0.7 V Typical



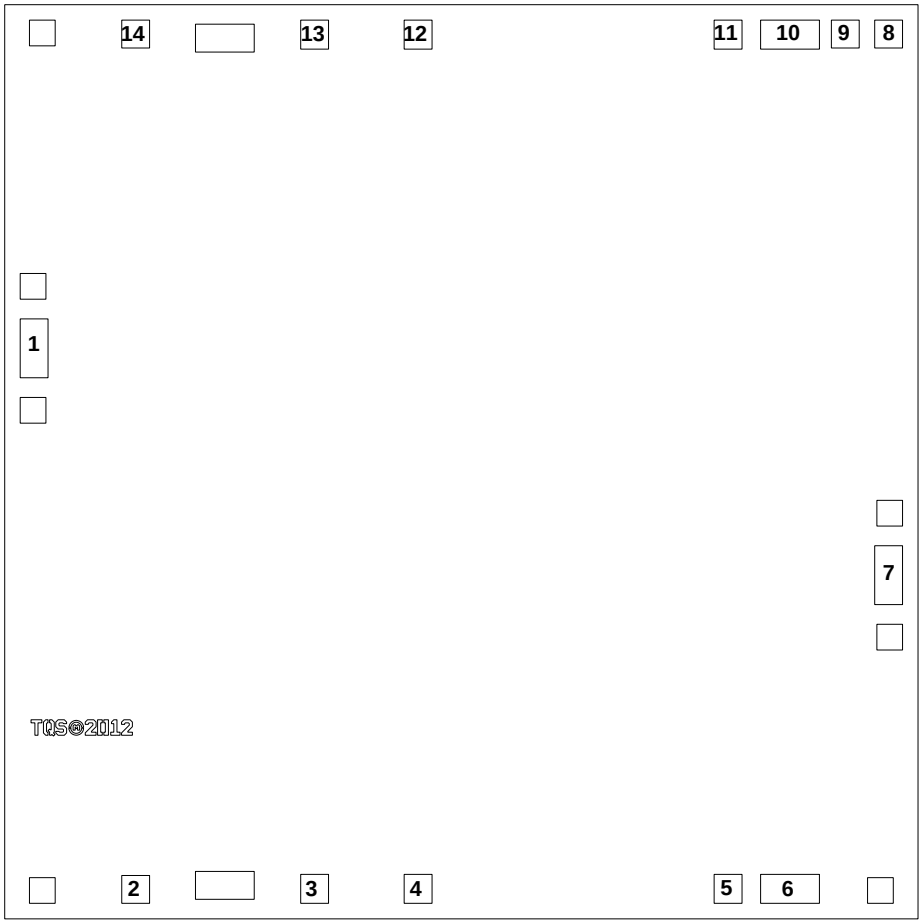
TOI vs. Frequency vs. Temperature
Vd = 6V, Id = 900 mA, Vg = -0.7 V Typical



Typical Performance

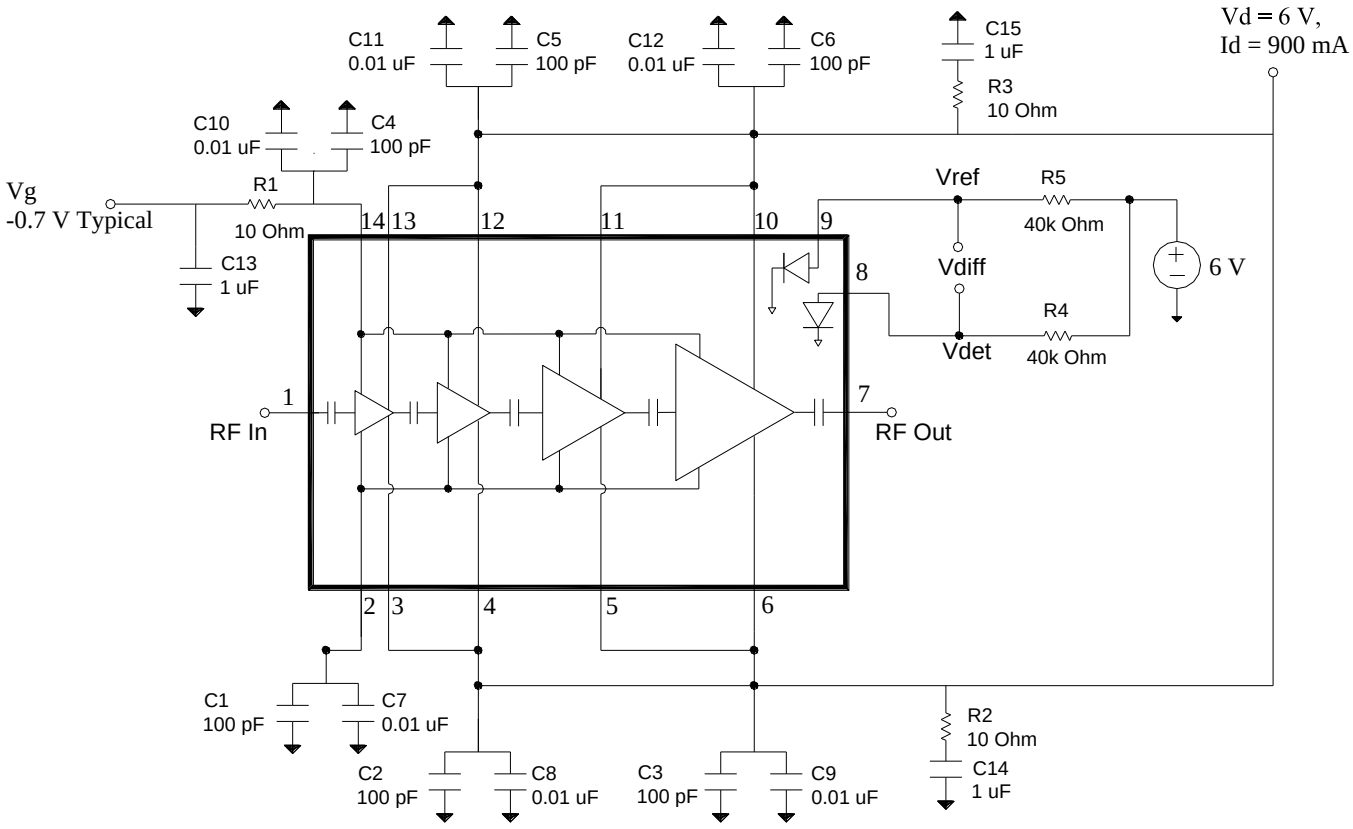


Bond Pad Description



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.

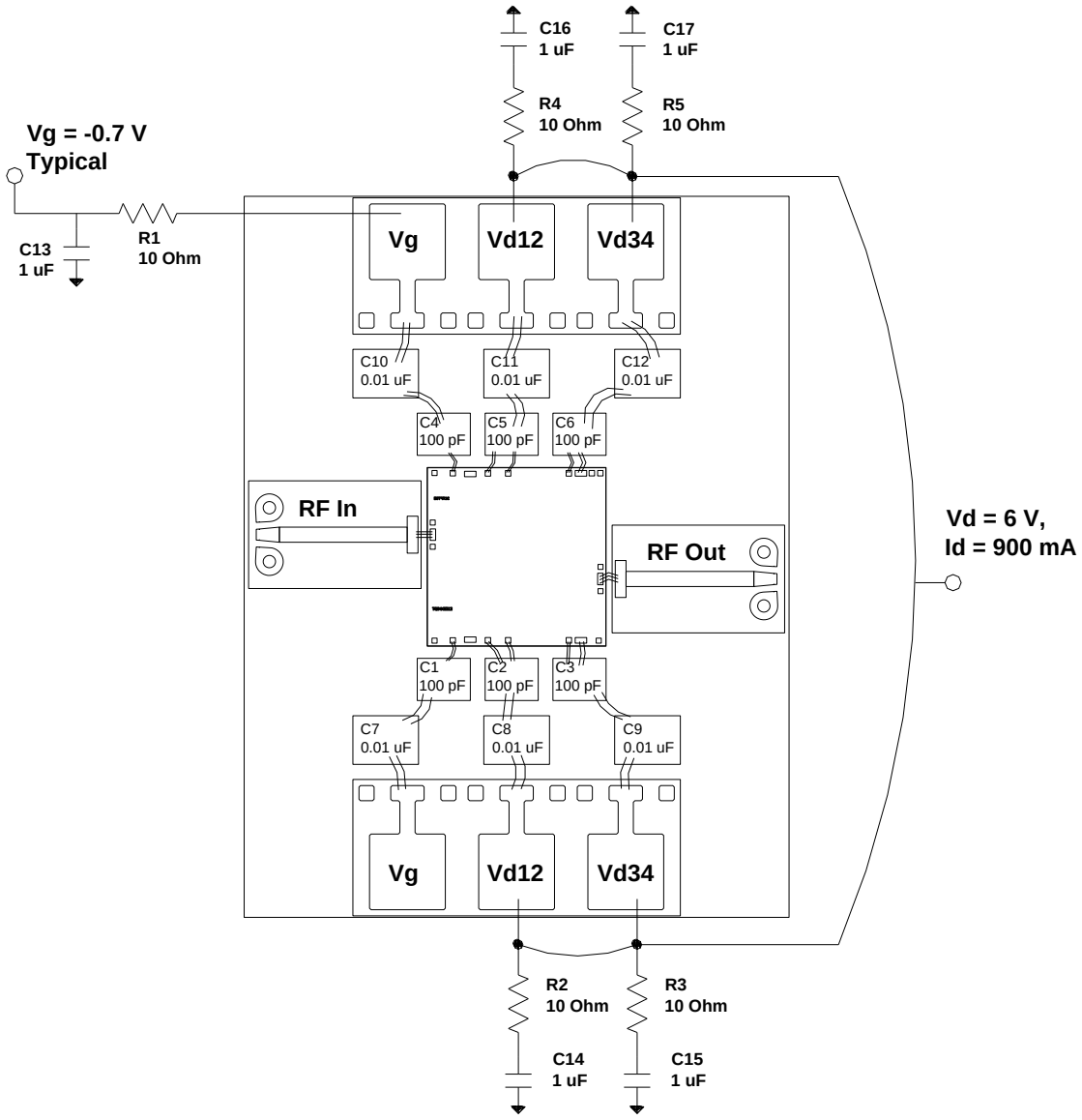
Application Circuit



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

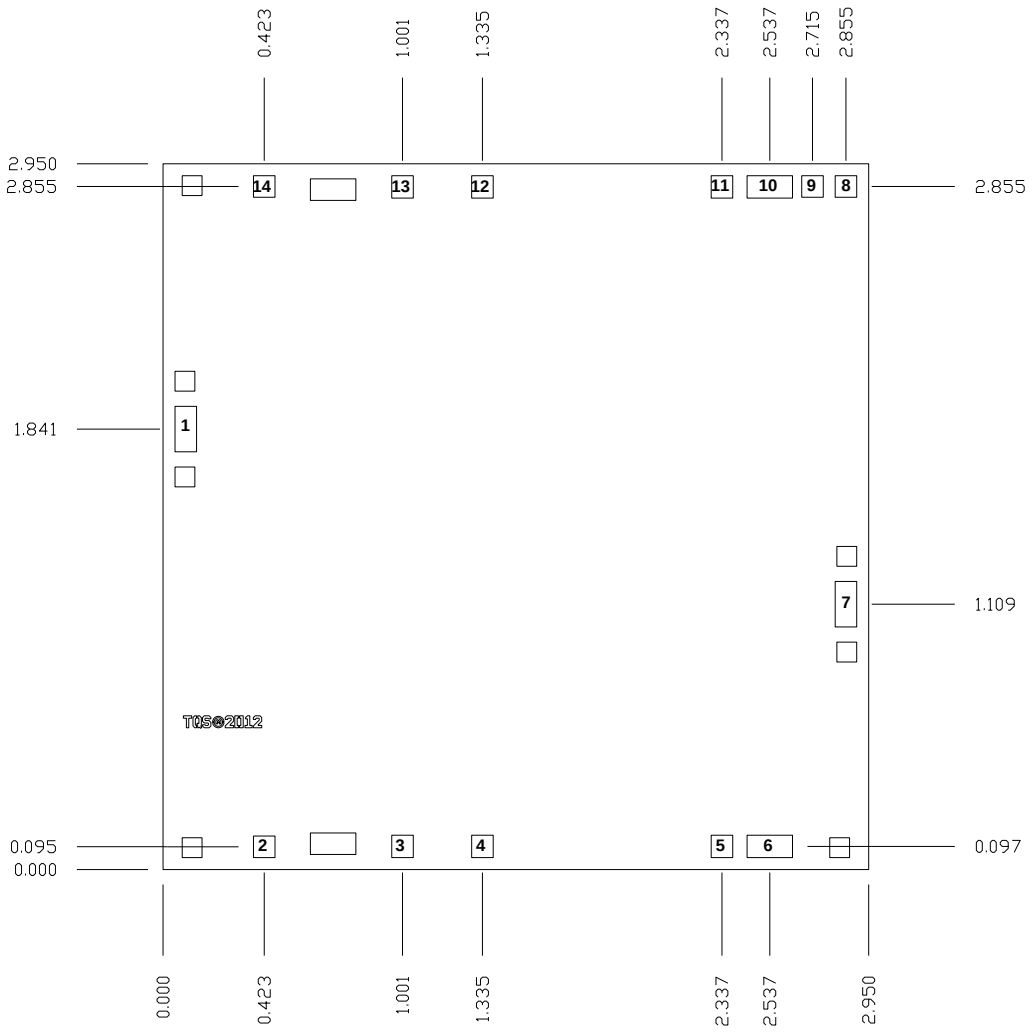
Application Circuit



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	

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

Product Compliance Information

ESD Information

Caution! ESD-Sensitive Device

ESD Rating:	Class 0
Value:	Passes 100V
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 ($C_{15}H_{12}Br_4O_2$) 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.
- 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.

Contact Information

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

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