# TGA4544-SM

## *26 – 31 GHz 1W Power Amplifier*

## Applications

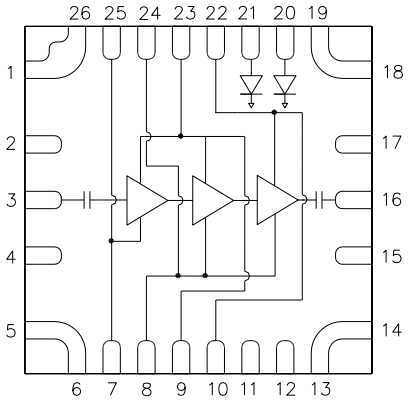
- Point-to-Point Radio
- Ka-band Sat-Com


26 lead 5x5mm ACQFN package

## Product Features

- Frequency Range: 26 – 31 GHz
- Power: 32 dBm Psat, 31 dBm P1dB
- Gain: 23 dB
- TOI: 41 dBm at 20 dBm/tone
- Integrated Power Detector
- Bias: Vd = 6 V, Idq = 1100 mA, Vg = -0.58 V Typical
- Package Dimensions: 5.0 x 5.0 x 1.3 mm

## Functional Block Diagram




## General Description

The TriQuint TGA4544-SM is a Ka-Band Power Amplifier with integrated power detector. The TGA4544-SM operates from 26 – 31 GHz and is designed using TriQuint's power pHEMT production process.

The TGA4544-SM typically provides 32 dBm of saturated output power with small signal gain of 23 dB. Third Order Intercept is 41 dBm at 20 dBm SCL.

The TGA4544-SM is available in a low-cost, surface mount 26 lead 5x5 ACQFN package and is ideally suited for Point-to-Point Radio.

Lead-free and RoHS compliant

Evaluation Boards are available upon request.

## Pin Configuration

| Pin No. | Label |
|---|---|
| 1, 2, 4, 5, 6, 12, 13, 14, 15, 17, 18, 19, 26 | GND |
| 3 | RF IN |
| 7, 25 | VG1 |
| 8, 24 | VG23 |
| 9, 23 | VD12 |
| 10, 22 | VD3 |
| 11 | NC |
| 16 | RFOUT |
| 20 | VDET |
| 21 | VREF |

## Ordering Information

| Part No. | ECCN | Description |
|---|---|---|
| TGA4544-SM | 3A001.b.2.d | 26 – 31 GHz 1W Power Amplifier |

Standard T/R size = 200 pieces on a 7" reel

## Absolute Maximum Ratings

| Parameter | Rating |
|---|---|
| Drain Voltage,Vd | 6.5 V |
| Gate Voltage,Vg | -3.5 to 0 V |
| Drain to Gate Voltage, Vd – Vg | 10 V |
| Drain Current, Id | 2.5 A |
| Gate Current, Ig | -7 to +52 mA |
| Power Dissipation, Pdiss | 16.2 W |
| RF Input Power, CW, T = 25 °C | 25 dBm |
| Channel Temperature, Tch | 200 °C |
| Mounting Temperature (30 sec) | 260 °C |
| Storage Temperature | -40 to 150 °C |

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

## Recommended Operating

| Parameter | Min | Typ | Max | Units |
|---|---|---|---|---|
| Operating Temp. Range | -40 | | +85 | °C |
| Vd | | 6.0 | | V |
| Idq | | 1100 | | mA |
| Id_drive | | 1536 | | mA |
| Vg | | -0.58 | | V |
| Ig_drive (Under RF Drive) | | 12 | | mA |

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

## Electrical Specifications

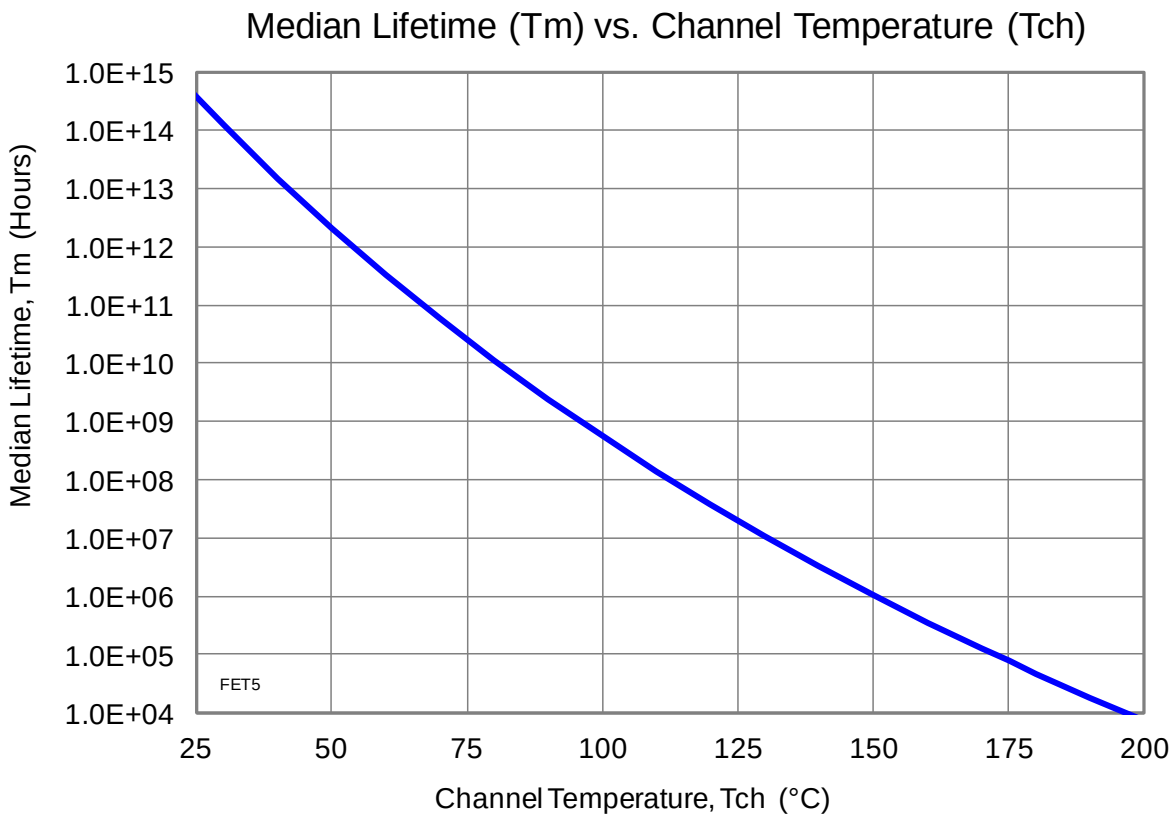
Test conditions unless otherwise noted: Vd =+6 V, Idq = 1100 mA, Vg =-0.58 V, Temp= +25°C, $Z_0$ = 50 Ω

| Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| Operational Frequency Range | | 26 | | 31 | GHz |
| Gain | | | 23 | | dB |
| Input Return Loss | | | 8 | | dB |
| Output Return Loss | | | 10 | | dB |
| Output Power @ Saturation | | | 32 | | dBm |
| Output Power @ 1 dB Gain Compression | | | 31 | | dBm |
| Output TOI @ 20 dBm/Tone Pout/tone | | | 41 | | dBm |
| Gain Temperature Coefficient | | | -0.03 | | dB/°C |
| Power Temperature Coefficient | | | -0.01 | | dBm/°C |

## Specifications

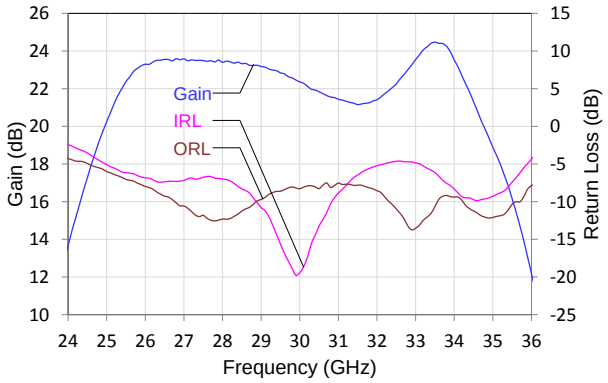
### Thermal and Reliability Information

| Parameter | Conditions | Rating |
|---|---|---|
| Thermal Resistance, $\theta_{JC}$, measured to back of package | Tbase = 85 °C | $\theta_{JC}$ = 10 °C/W |
| Channel Temperature (Tch), and Median Lifetime (Tm) | Tbase = 85 °C<br>Vd = 6 V Id = 1100 mA<br>Pdiss = 6.6 W | Tch = 151 °C<br>Tm = 9.3E+5 Hours |

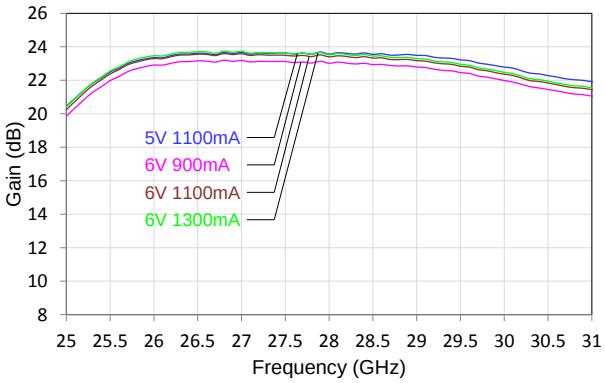


## Typical Performance

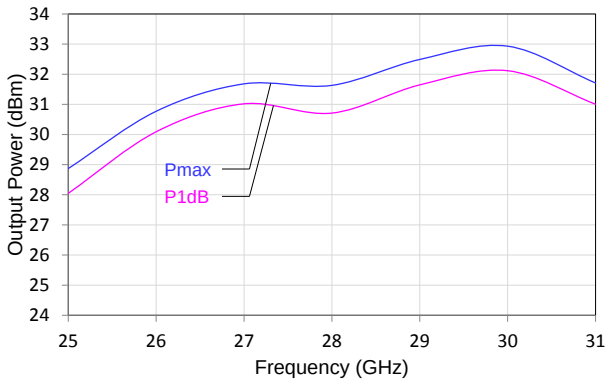
S-Parameters vs. Frequency
Vd = 6 V, Id = 1100 mA, Vg = -0.58 V Typical, +25°C



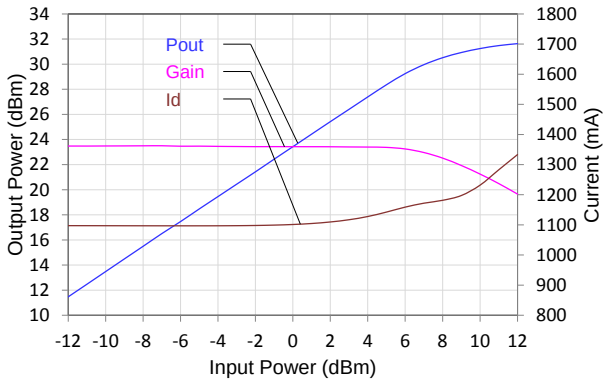

Gain vs. Frequency vs. Bias
Vd = 5 - 6 V, Id = 900 - 1300 mA, Vg = -0.58V Typical



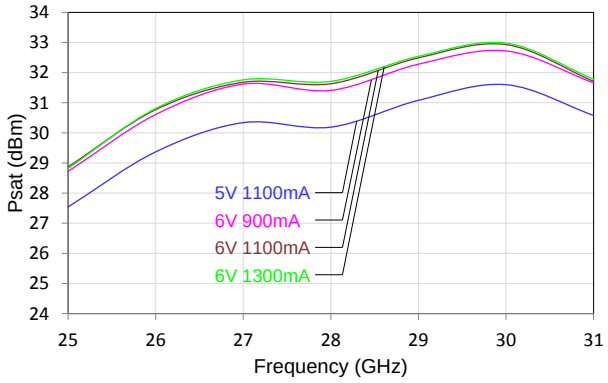

Output Power vs. Frequency
Vd = 6 V, Id = 1100 mA, Vg = -0.58V Typical



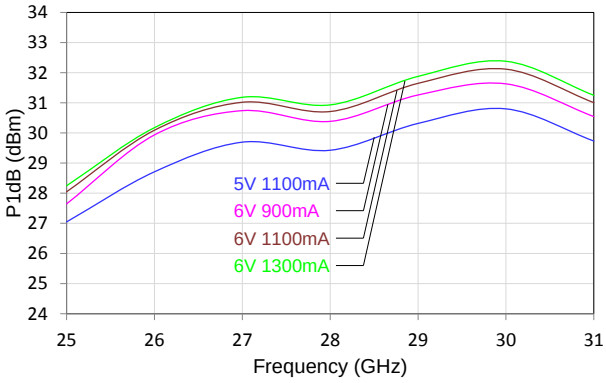

Pout, Gain, Id vs. Pin @ 28GHz
Vd = 6 V, Id = 1100 mA, Vg = -0.58V Typical




Psat vs. Frequency vs. Bias
Vd = 5 - 6 V, Id = 900 - 1300 mA, Vg = -0.58V Typical

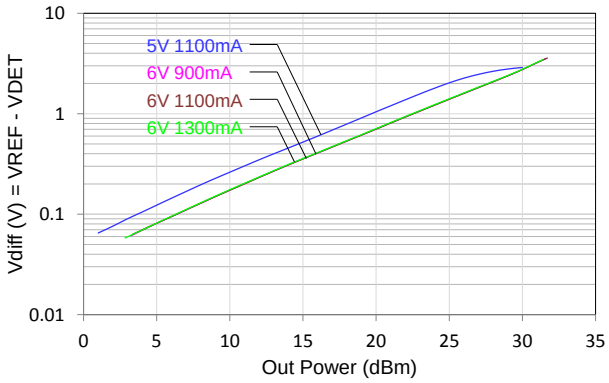



P1dB vs. Frequency vs. Bias
Vd = 5 - 6 V, Id = 900 - 1300 mA, Vg = -0.58V Typical

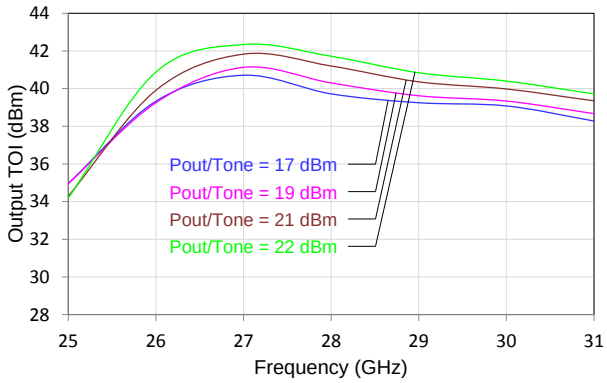


## Typical Performance

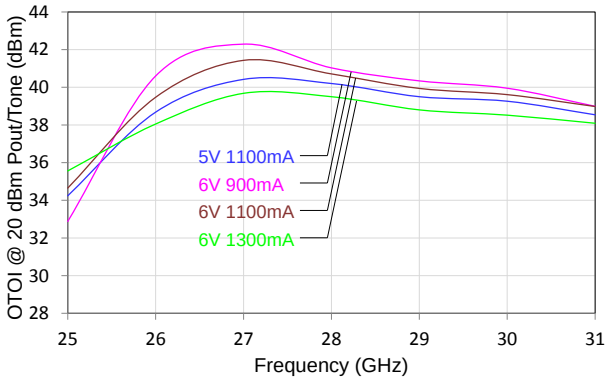
Power Detector vs. Pout vs. Bias @ 28GHz
Vd = 5 - 6 V, Id = 900 - 1300 mA, Vg = -0.58V Typical



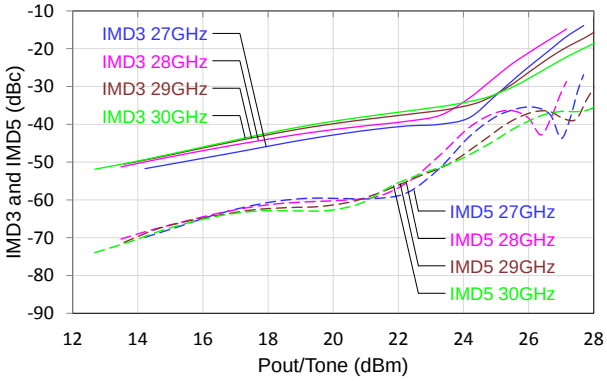

Output TOI vs. Frequency
Vd = 6 V, Id = 1100 mA, Vg = -0.58V Typical, 25°C



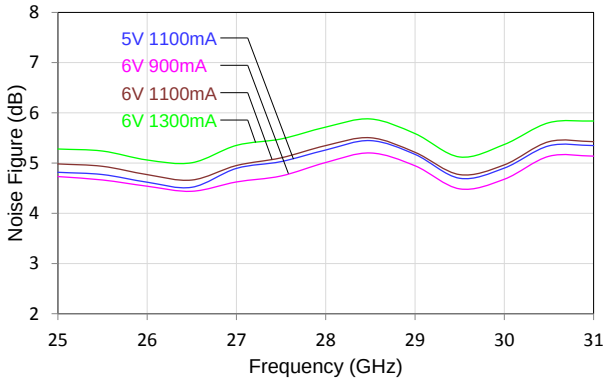

Output TOI vs. Frequency vs. Bias
Vd = 5 - 6 V, Id = 900 - 1300 mA, Vg = -0.58V Typical




IMD3 and IMD5 vs. Pout/Tone vs. Frequency
Vd = 6 V, Id = 1100 mA, Vg = -0.58V Typical, 25°C

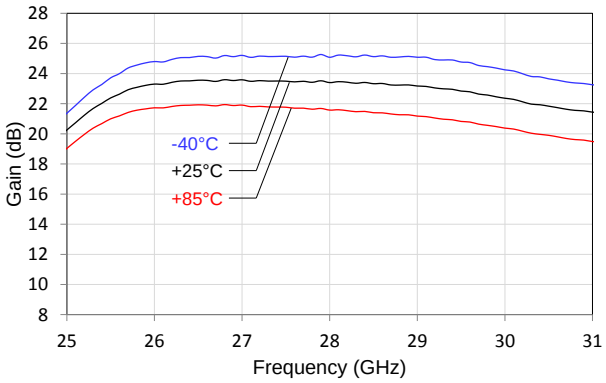



Noise vs. Frequency vs. Bias
Vd = 5 - 6 V, Id = 900 - 1300 mA, Vg = -0.58V Typical

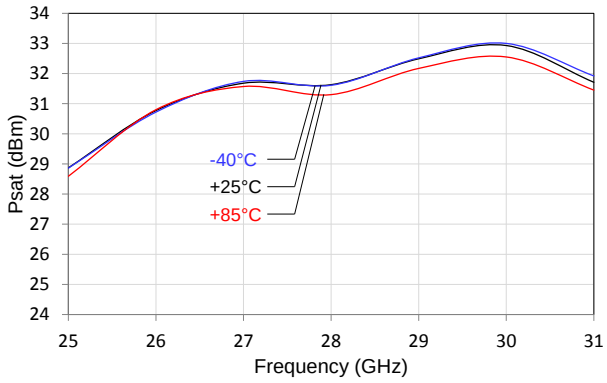


## Typical Performance

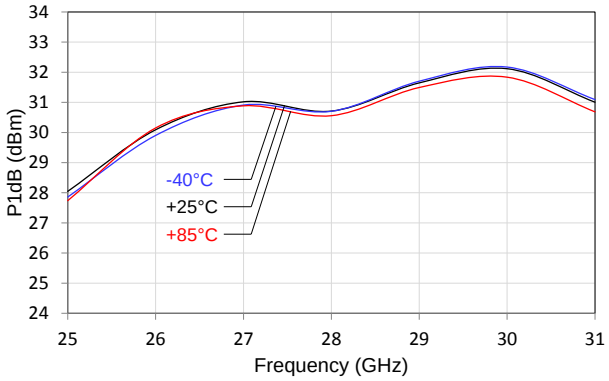
Gain vs. Frequency vs. Temperature
Vd = 6V, Id = 1100mA, Vg = -0.58V Typical



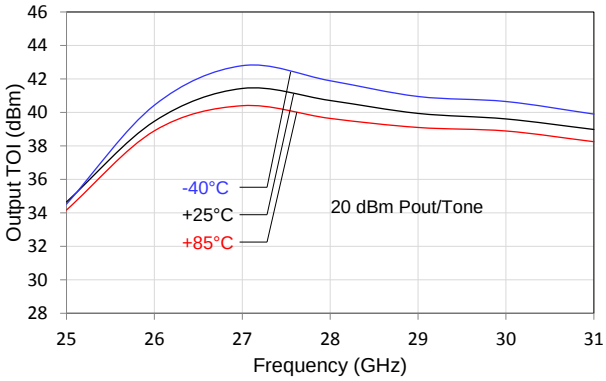

Psat vs. Frequency vs. Temperature
Vd = 6V, Id = 1100mA, Vg = -0.58V Typical



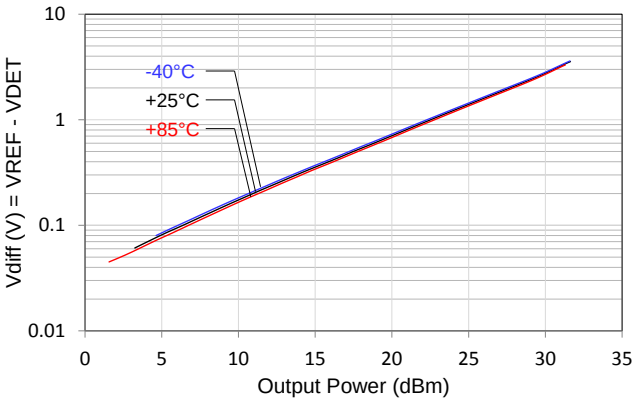

P1dB vs. Frequency vs. Temperature
Vd = 6V, Id = 1100mA, Vg = -0.58V Typical



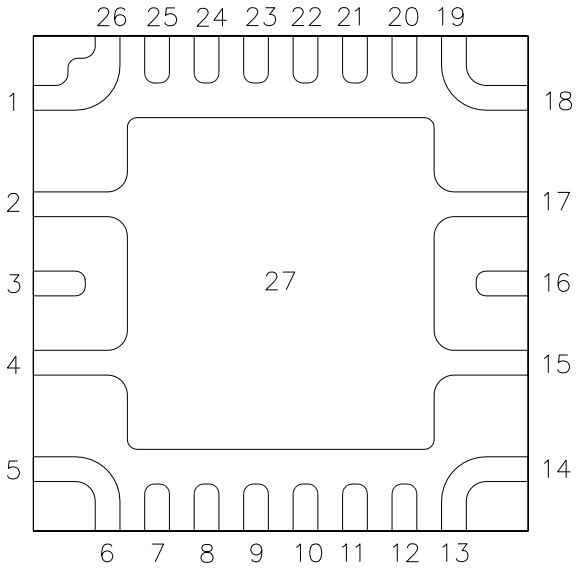

Output TOI vs. Frequency vs. Temperature
Vd = 6V, Id = 1100mA, Vg = -0.58V Typical




Power Detector vs. Pout vs. Temperature
Vd = 6V, Id = 1100mA, Vg = -0.58V Typical



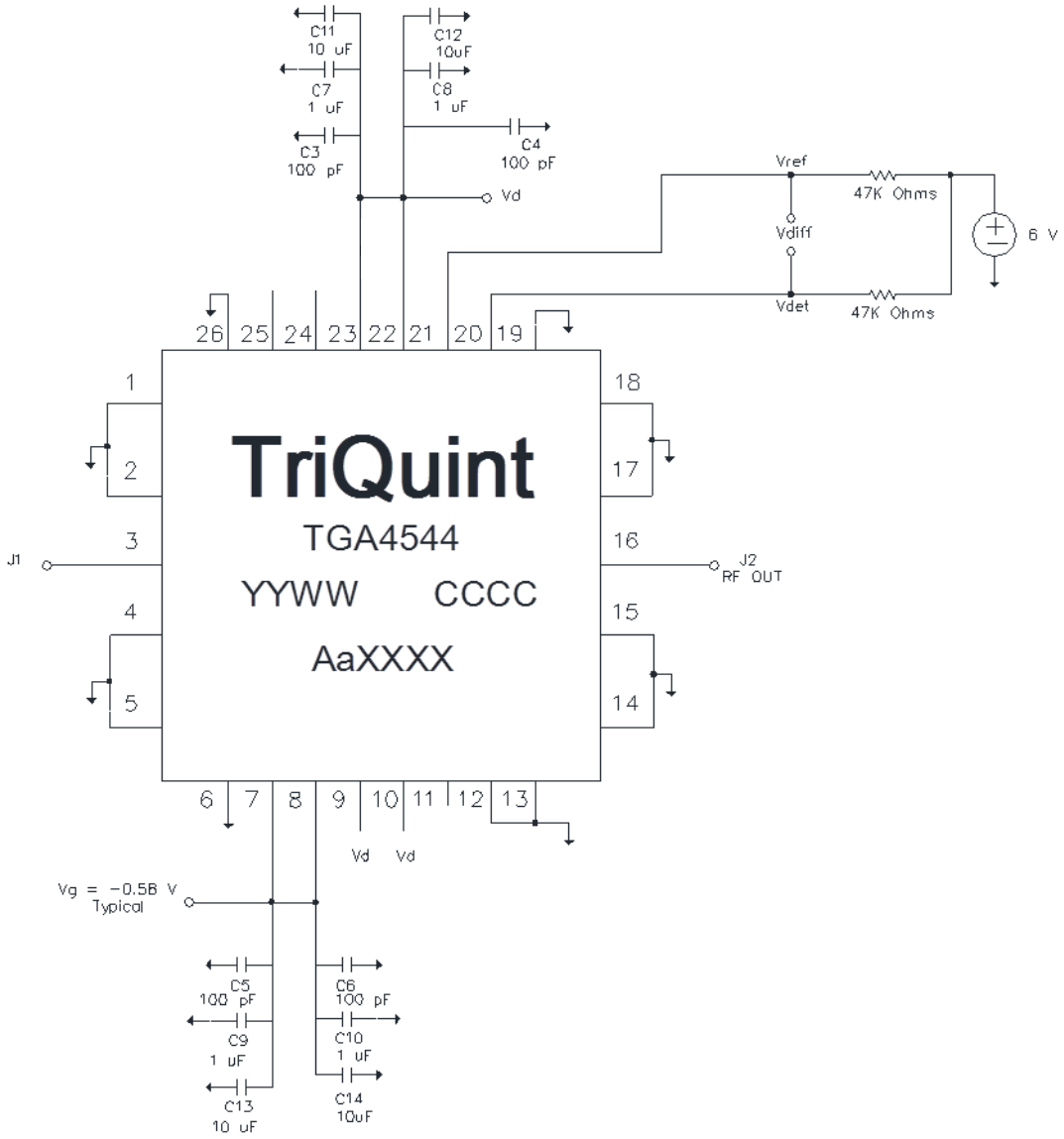
## Pin Configuration and Description




| Pin No. | Label | Description |
|---|---|---|
| 1, 5, 6, 13 14, 18, 19, 26 | GND | Must be connected to Ground |
| 2, 4, 15, 17, 27 | GND | Backside paddle. Multiple vias should be employed to minimize inductance and thermal resistance; see 'PCB Mounting Pattern' on page 11 for suggested footprint |
| 3 | RF IN | RF input, matched to 50 ohms |
| 7, 25 | VG1 | Stage 1 gate voltage (1) |
| 8, 24 | VG23 | Stage 2 and 3 gate voltage (1) |
| 9, 23 | VD12 | Stage 1 and 2 drain voltage |
| 10, 22 | VD3 | Stage 3 drain voltage |
| 11 | NC | No internal connection; Can be grounded on PCB or left open |
| 12 | GND | Internally connected to GND. Can be grounded on the PCB or left open |
| 16 | RF OUT | RF output, matched to 50 ohms |
| 20 | VDET | Detector diode output voltage. Varies with RF output power |
| 21 | VREF | Reference diode output voltage |

(1) Bias bypass network is required; see 'Application Circuit' on page 8 as an example.

## Application Circuit



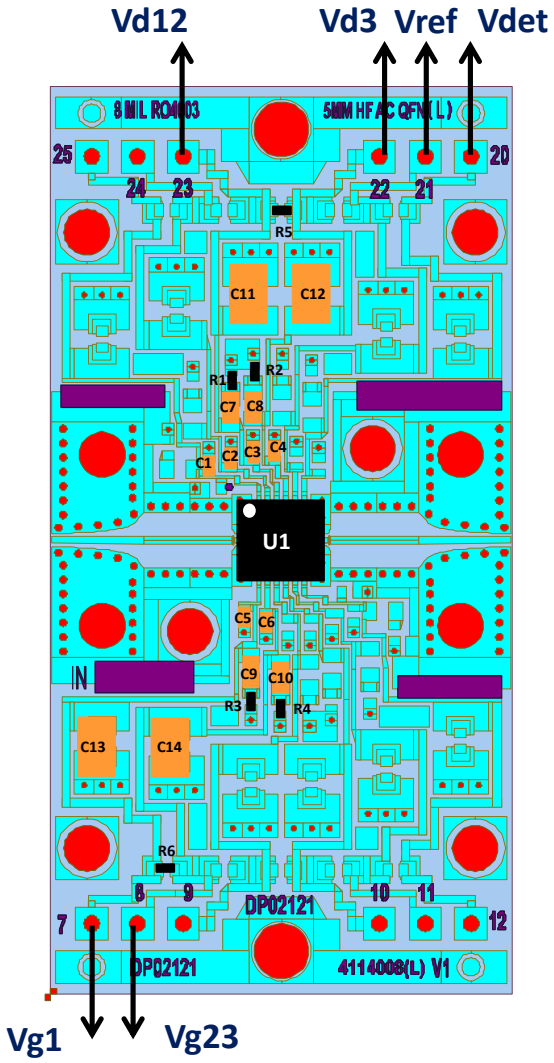

Vd can be biased from either side (pin 9, 10 or pin 21, 22)

| Bias-up Procedure | Bias-down Procedure |
|---|---|
| Vg set to -1.5 V | Turn off RF supply |
| Vd set to +6 V | Reduce Vg to -1.5 V. Ensure Id ~ 0 mA |
| Adjust Vg more positive until quiescent Id is 1100 mA. This will be ~ Vg = -0.58 V typical | Turn Vd to 0 V |
| Apply RF signal to RF Input | Turn Vg to 0 V |

## Application Circuit

### PC Board Layout

Board material is Rogers Corp. 4003 0.008" thickness with ½ oz copper cladding.
For further technical information, refer to the TGA4544-SM Product Information page.




### Bill of Material

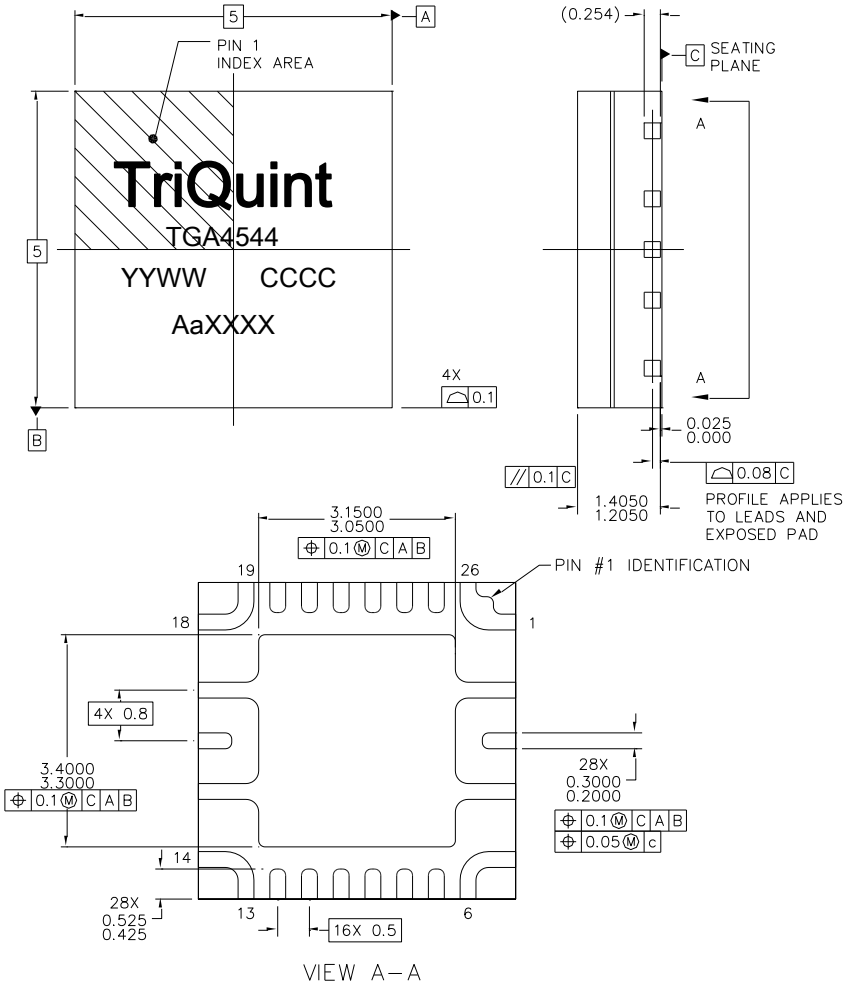
| Ref Des | Value | Description | Manufacturer | Part Number |
|---|---|---|---|---|
| U1 | | Ka Band Power Amplifier | TriQuint | TGA4544-SM |
| C1, C2 | DNP | | | |
| C3 thru C6 | 100.0 pF | Cap, 0402, 20V, 5%, COG | various | |
| C7 thru C10 | 1.0 µF | Cap, 0603/0805, 25V, 5%, COG | various | |
| C11 thru C14 | 10.0 µF | Cap, 0805, 25V, COG | various | |

| | | | | |
|---|---|---|---|---|
| R1 thru R6 | 0 Ω | Res. 0402, 1/16 W, 5% SMT | various | |

## Mechanical Information

### Package Marking and Dimensions

All dimensions are in millimeters.

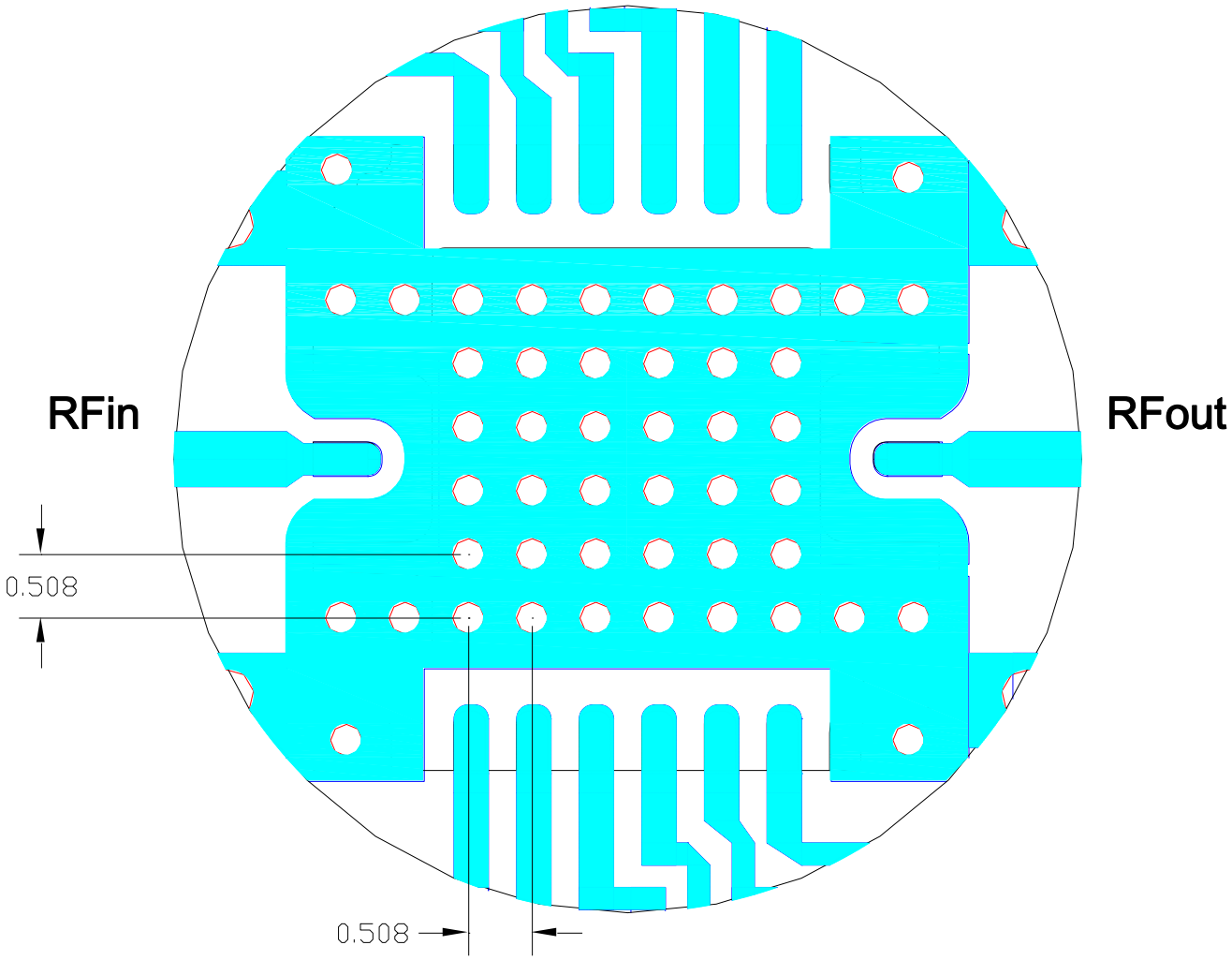



The TGA4544-SM will be marked with the “YYWW” designator and a lot code marked below the part designator. The “YY” represents the last two digits of the year the part was manufactured, the “WW” is the work week, the “CCCC” is the country code, the “Aa” is the vendor, and the “XXXX” is the last 4 digit of lot number.

This package is lead-free/RoHS-compliant with a copper alloy base (CDA194), and the plating material on the leads is NiPdAu. It is compatible with lead-free (maximum 260 °C reflow temperature) soldering process.

## Mechanical Information

### PCB Mounting Pattern



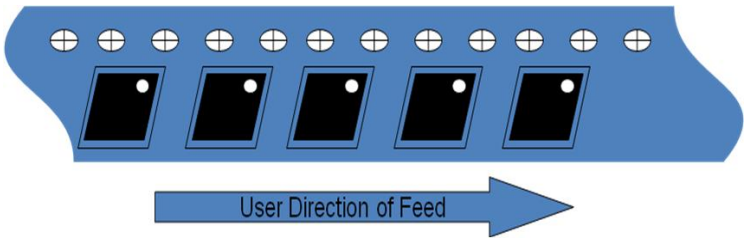

Notes:

1. The pad pattern shown has been developed and tested for optimized assembly at TriQuint Semiconductor. The PCB land pattern has been developed to accommodate lead and package tolerances. Since surface mount processes vary from company to company, careful process development is recommended.
2. Ground vias are critical for the proper performance of this device. Vias have a final plated thru diameter of .25 mm (.010”).

## Tape and Reel Information

Standard T/R size = 200 pieces on a 7” reel

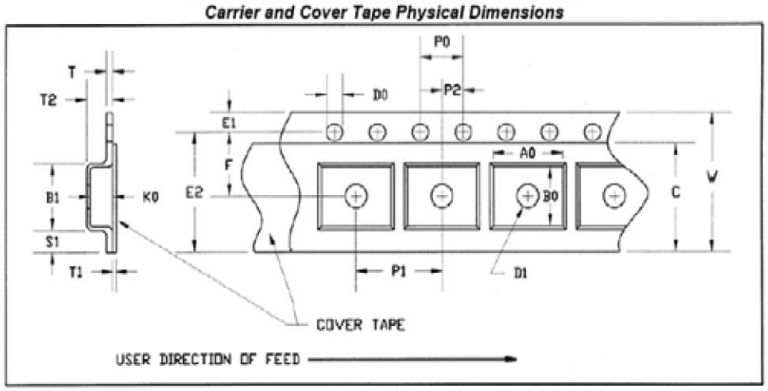
Vendor: Tek-Pak P/N QFN0500x0500F-L500




### CARRIER AND COVER TAPE DIMENSIONS

| Part | Feature | Symbol | Size (in) | Size (mm) |
|---|---|---|---|---|
| Cavity | Length | A0 | 0.209 | 5.3 |
| | Width | B0 | 0.209 | 5.3 |
| | Depth | K0 | 0.064 | 1.65 |
| | Pitch | P1 | 0.315 | 8.00 |
| Cover Tape | Width | C | 0.362 | 9.2 |
| Carrier Tape | Width | W | 0.472 | 12.00 |

*Carrier and Cover Tape Physical Dimensions*



## Product Compliance Information

### ESD Sensitivity Ratings

Caution! ESD-Sensitive Device

ESD Rating: Class 1A
Value: Passed ≥ 300 V min.
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

### Solderability

Compatible with lead-free (260°C maximum reflow temperature).

Package lead plating: NiPdAu.

The use of no-clean solder to avoid washing after soldering is recommended.

This package is not compatible with solder containing lead.

### MSL Rating

MSL Rating: Level 3
Test: 260°C convection reflow
Standard: JEDEC Standard IPC/JEDEC J-STD-020

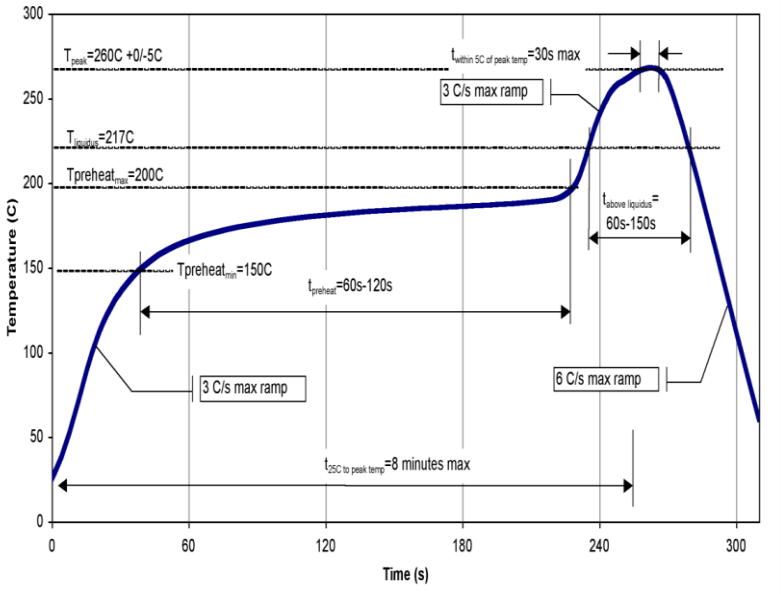
### RoHs Compliance

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

## Recommended Solder Temperature Profile



## Contact Information

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

**Web:** www.triquint.com **Tel: 1-844-890-8163**
**Email:** customer.support@qorvo.com

For information about the merger of RFMD and TriQuint as Qorvo:

**Web:** www.qorvo.com

For technical questions and application information: **Email:** info-networks@tqs.com

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