

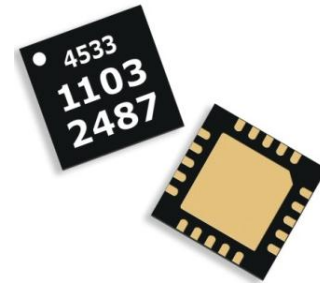
# TGA4533-SM

## K-Band Power Amplifier



### Applications

- Point-to-Point Radio
- K-Band Sat-Com

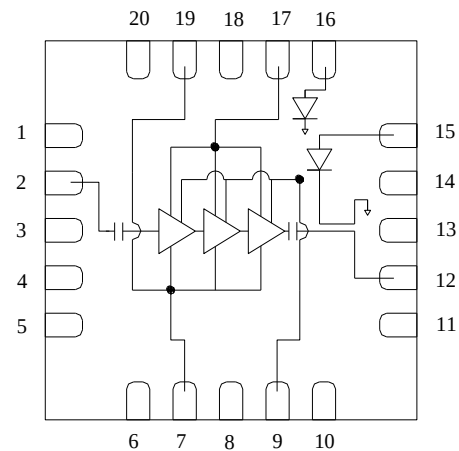


QFN 4x4 mm 20L

### Product Features

- Frequency Range: 21.2 – 23.6 GHz
- Power: 32 dBm Psat, 31 dBm P1dB
- Gain: 22 dB
- TOI: 41 dBm at 21 dBm SCL
- NF: 6 dB
- Integrated Power Detector
- Bias:  $V_d = 6\text{ V}$ ,  $I_{dq} = 880\text{ mA}$ ,  $V_g = -0.7\text{ V}$  Typical
- Package Dimensions: 4.0 x 4.0 x 0.85 mm

### Functional Block Diagram



### General Description

The TriQuint TGA4533-SM is a K-Band Power Amplifier. The TGA4533-SM operates from 21.2 – 23.6 GHz and is designed using TriQuint's power pHEMT production process.

The TGA4533-SM typically provides 31 dBm of output power at 1dB gain compression with small signal gain of 22 dB. Third Order Intercept is 41 dBm at 21 dBm SCL.

The TGA4533-SM is available in a low-cost, surface mount 20 lead 4x4 QFN package. It is ideally suited for Point-to-Point Radio, and K-Band Sat-Com.

Lead-free and RoHS compliant

Evaluation Boards are available upon request.

### Pin Configuration

| Pin #                             | Symbol    |
|-----------------------------------|-----------|
| 1, 3, 4, 5, 6, 10, 11, 13, 14, 20 | N/C       |
| 2                                 | RF IN     |
| 7, 19                             | $V_g$     |
| 8, 18                             | GND       |
| 12                                | RF OUT    |
| 9, 17                             | $V_d$     |
| 15                                | $V_{det}$ |
| 16                                | $V_{ref}$ |

### Ordering Information

| Part No.   | ECCN  | Description            |
|------------|-------|------------------------|
| TGA4533-SM | EAR99 | K-Band Power Amplifier |

Standard T/R size = 500 pieces on a 7" reel.

### Specifications

#### Absolute Maximum Ratings

| Parameter                         | Rating         |
|-----------------------------------|----------------|
| Drain Voltage, Vd                 | +6.5 V         |
| Gate Voltage, Vg                  | -3 to 0 V      |
| Drain to Gate Voltage, Vd – Vg    | 10 V           |
| Drain Current, Id                 | 2 A            |
| Gate Current, Ig                  | -8.8 to 113 mA |
| Power Dissipation, Pdiss          | 12.7 W         |
| RF Input Power, CW, T = 25°C      | 26 dBm         |
| Channel Temperature, Tch          | 200 °C         |
| Mounting Temperature (30 Seconds) | 260 °C         |
| Storage Temperature               | -40 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                 | Min | Typical | Max | Units |
|---------------------------|-----|---------|-----|-------|
| Vd                        |     | 6       |     | V     |
| Idq                       |     | 880     |     | mA    |
| Id_drive (Under RF Drive) |     | 1300    |     | mA    |
| Vg                        |     | -0.7    |     | V     |

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

#### Electrical Specifications

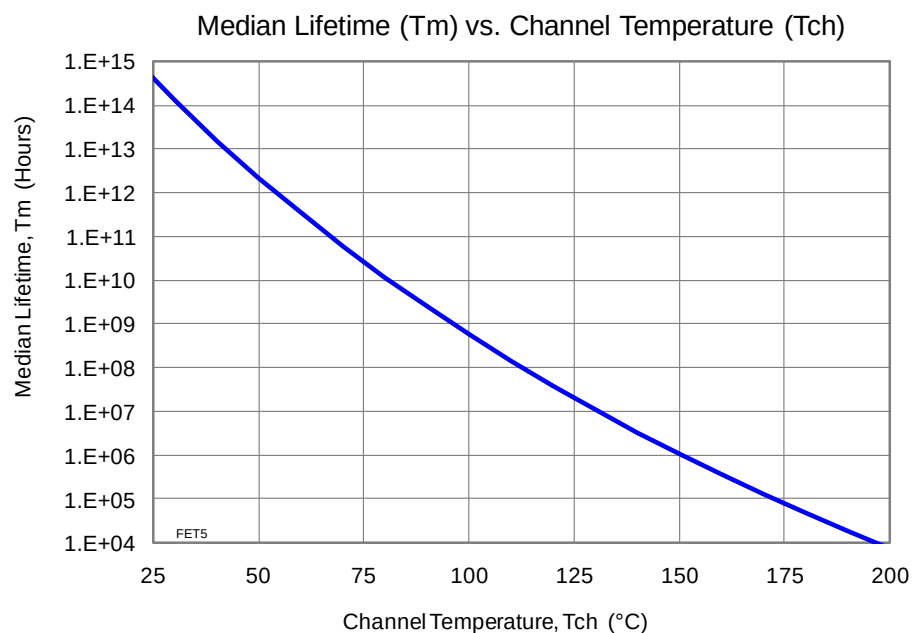
Test conditions unless otherwise noted: 25 °C, Vd = 6 V, Idq = 880 mA, Vg = -0.7 V Typical.

| Parameter                                 | Min  | Typical | Max  | Units |
|-------------------------------------------|------|---------|------|-------|
| Operational Frequency Range               | 21.2 |         | 23.6 | GHz   |
| Gain                                      | 19   | 22      |      | dB    |
| Input Return Loss, IRL                    |      | 10      |      | dB    |
| Output Return Loss, ORL                   |      | 10      |      | dB    |
| Output Power @ Saturation, Psat           | 30   | 32      |      | dBm   |
| Output Power @ 1dB Gain Compression, P1dB | 28   | 31      |      | dBm   |
| Output Third Order Intercept, TOI         | 38.5 | 41      |      | dBm   |
| Noise Figure, NF                          |      | 6       |      | dB    |
| Gain Temperature Coefficient              |      | -0.025  |      | dB/°C |
| Power Temperature Coefficient             |      | -0.015  |      | dB/°C |

### Specifications (cont.)

### Thermal and Reliability Information

| Parameter                                                             | Condition                                                          | Rating                             |
|-----------------------------------------------------------------------|--------------------------------------------------------------------|------------------------------------|
| Thermal Resistance, $\theta_{JC}$ , measured to back of package       | Tbase = 85 °C                                                      | $\theta_{JC}$ = 9.0 °C/W           |
| Channel Temperature (Tch), and Median Lifetime (Tm)                   | Tbase = 85 °C, Vd = 6 V, Idq = 880 mA, Pdis = 5.28 W               | Tch = 133 °C<br>Tm = 7.4 E+6 Hours |
| Channel Temperature (Tch), and Median Lifetime (Tm)<br>Under RF Drive | Tbase = 85 °C, Vd = 6 V, Id = 1300 mA, Pout = 31 dBm, Pdis = 6.2 W | Tch = 144 °C<br>Tm = 2.0 E+6 Hours |

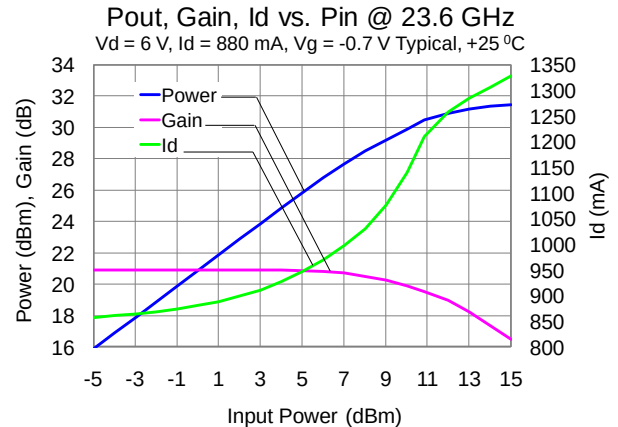
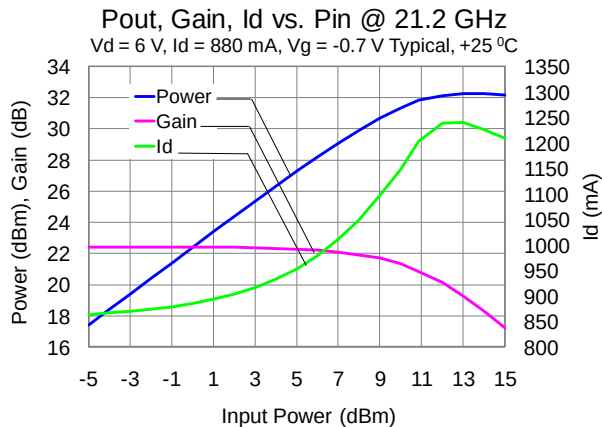
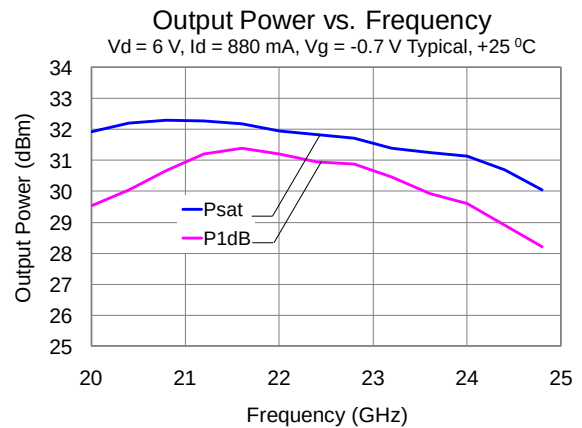
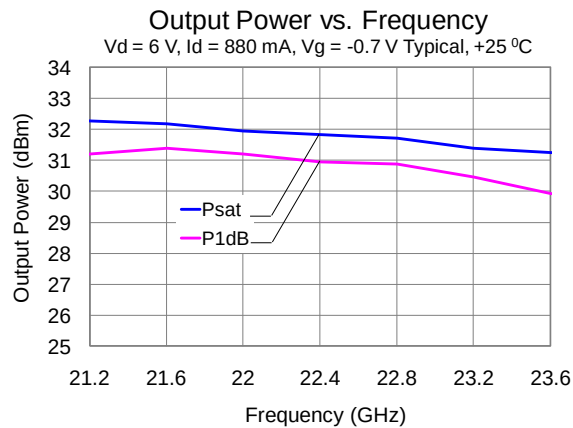
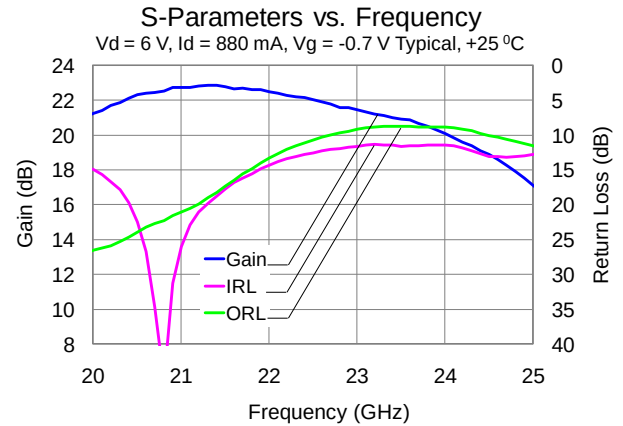
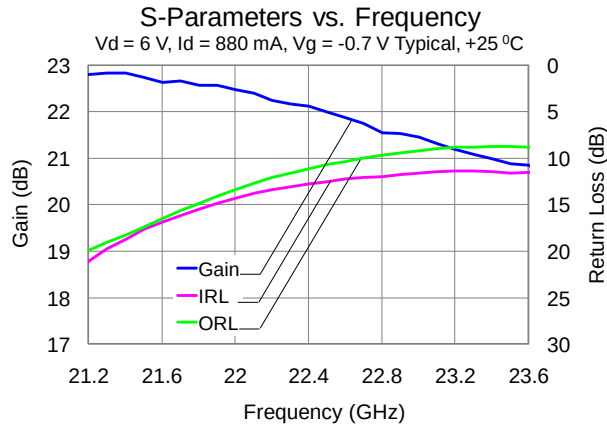


# TGA4533-SM

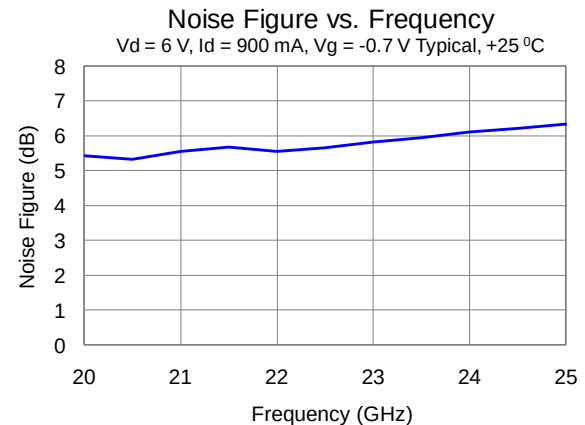
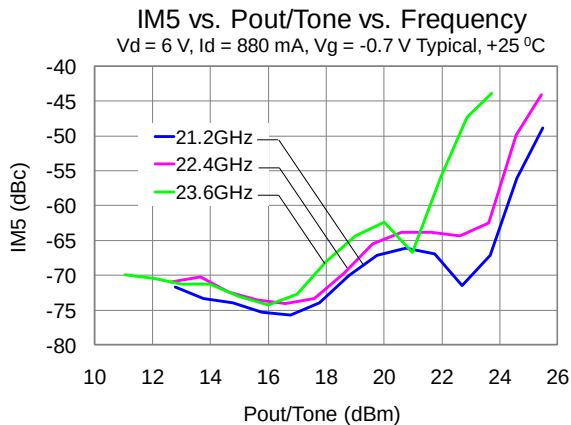
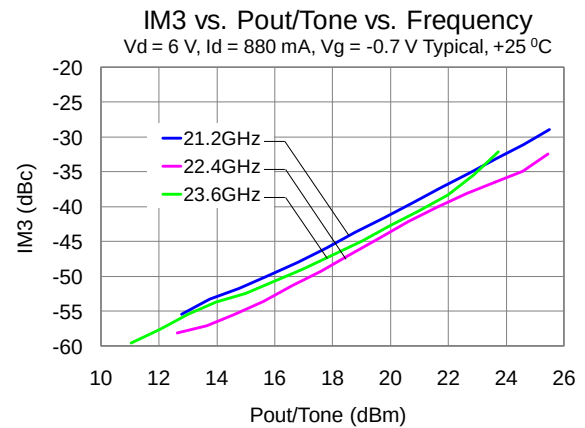
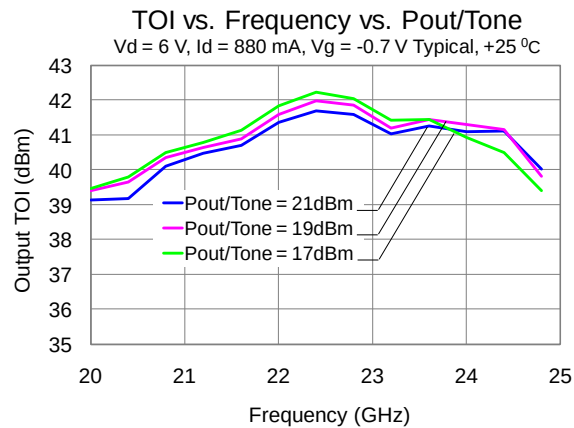
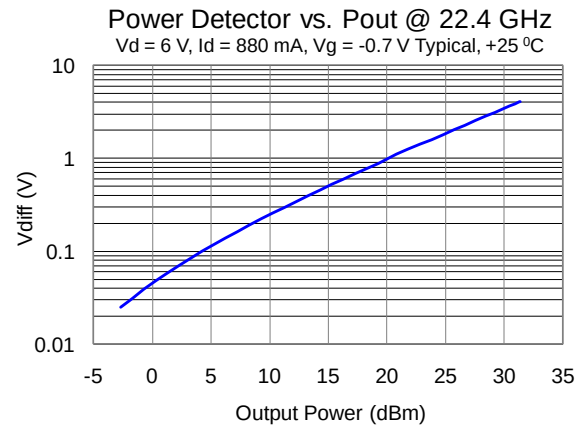
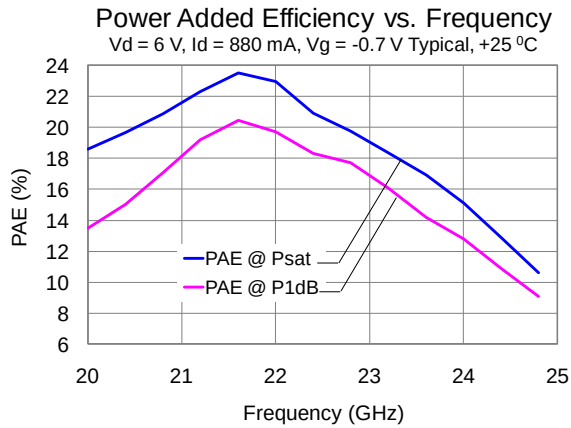
## K-Band Power Amplifier



### Typical Performance



### Typical Performance (cont.)

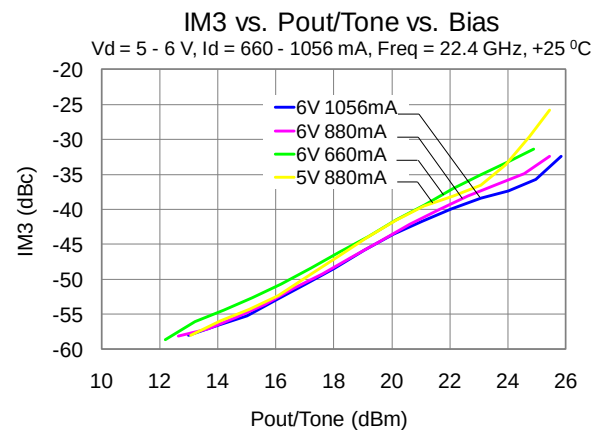
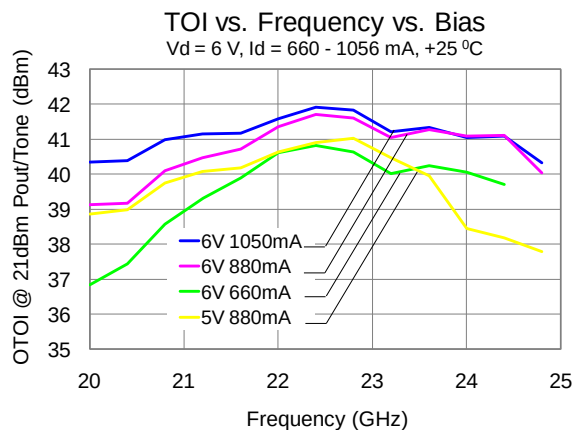
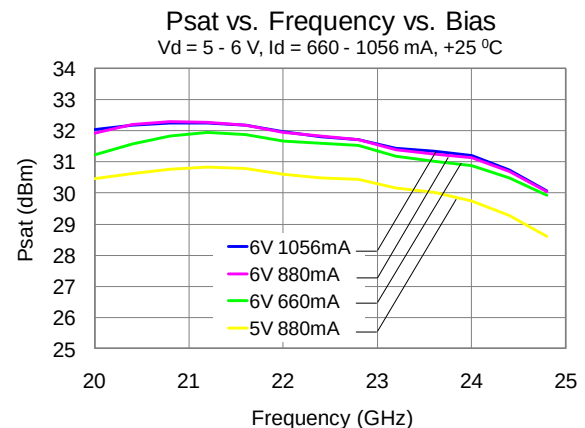
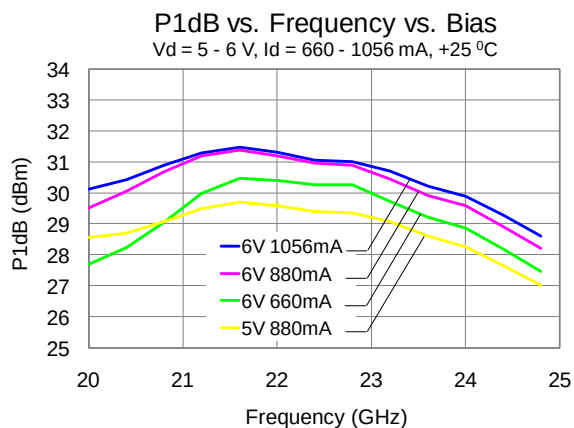
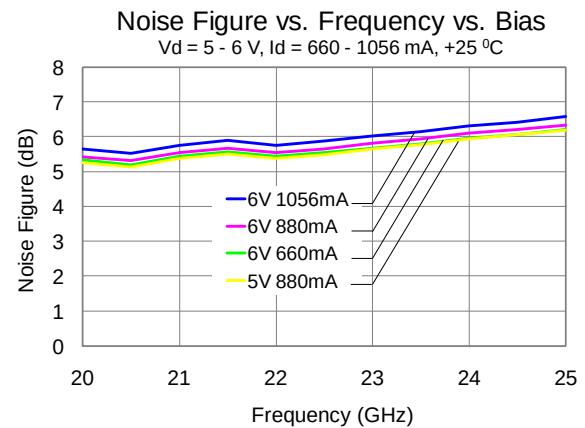
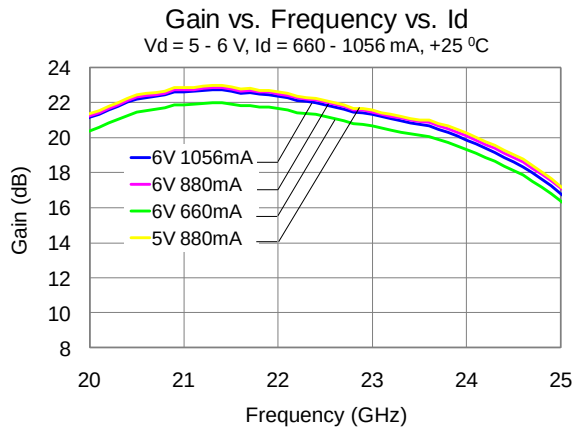


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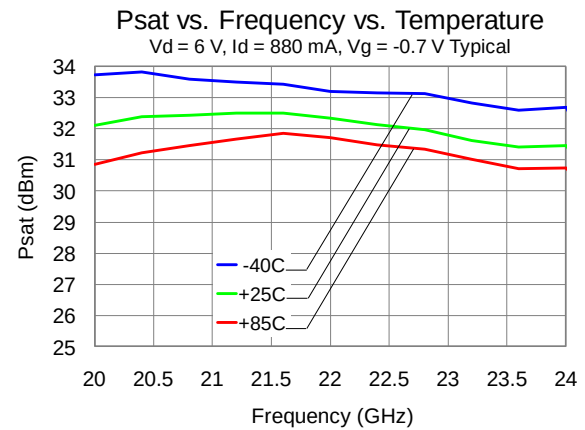
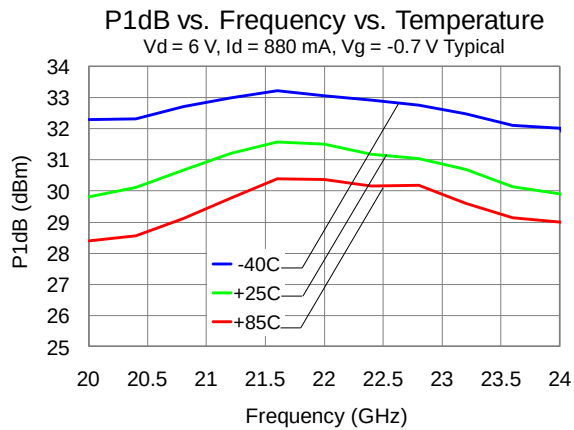
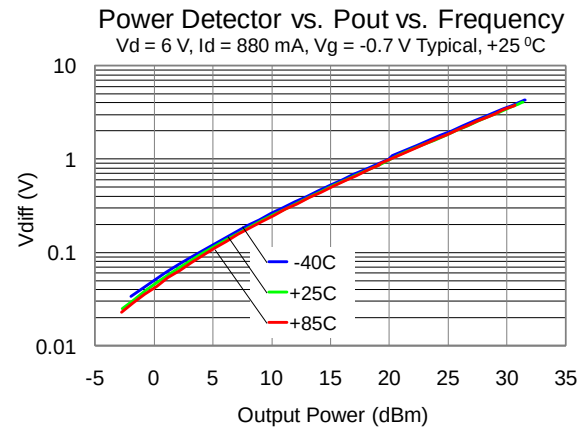
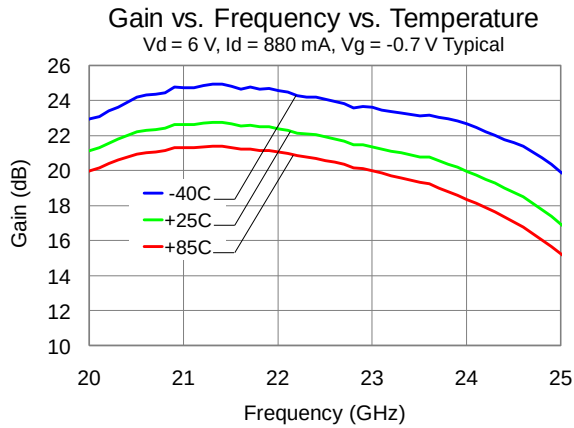
## K-Band Power Amplifier



### Typical Performance (cont.)



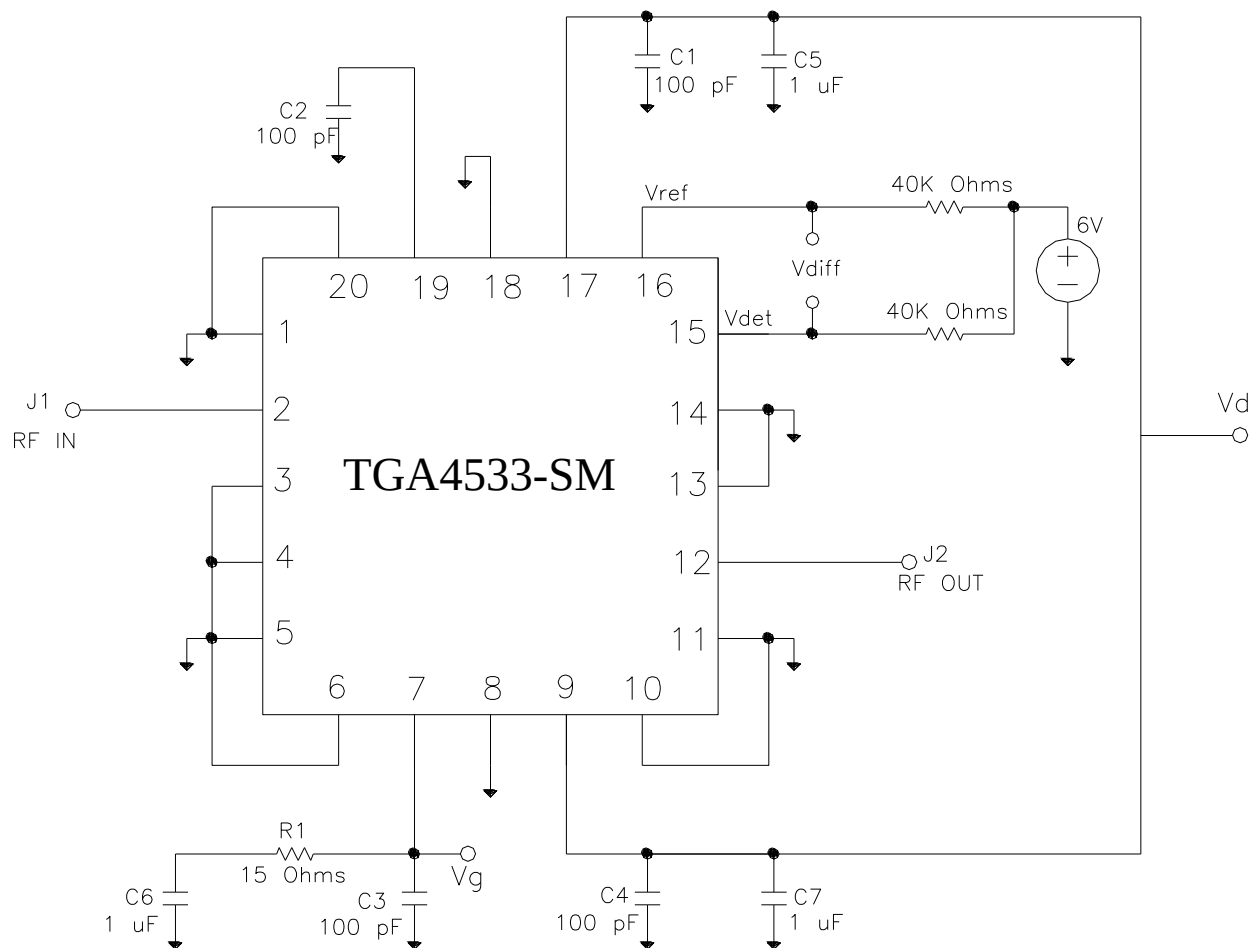
### Typical Performance (cont.)



# TGA4533-SM

## K-Band Power Amplifier

### Application Circuit

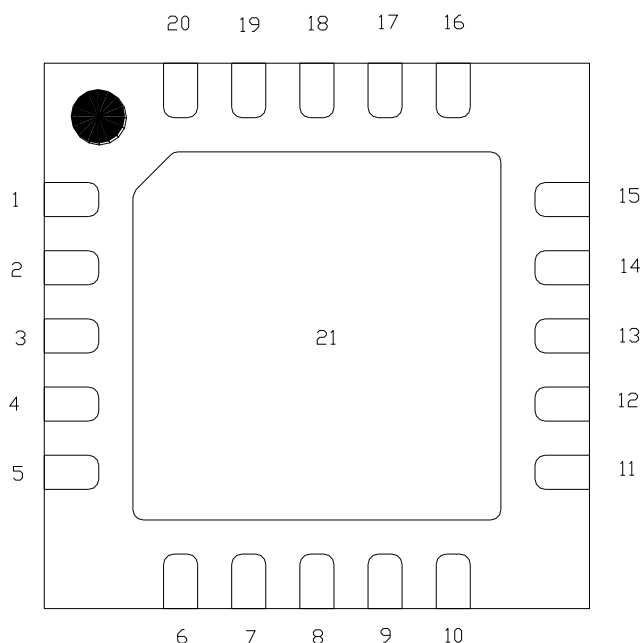


Vg can be biased from either side (pin 7 or pin 19), and the non-biased side can be left open.  
Vd must be biased from both sides (pin 9 and pin 17).

| 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 880 mA.<br>This will be ~ Vg = -0.7 V typical | Turn Vd to 0 V                       |
| Apply RF signal to RF Input                                                                 | Turn Vg to 0 V                       |



### Pin Description



| Pin                               | Symbol           | Description                                                                                                                                                     |
|-----------------------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1, 3, 4, 5, 6, 10, 11, 13, 14, 20 | N/C              | No internal connection; must be grounded on PCB                                                                                                                 |
| 2                                 | RF IN            | Input, matched to 50 ohms                                                                                                                                       |
| 7, 19                             | V <sub>g</sub>   | Gate voltage. Bias network is required; can be biased from either pin, and non-biased pin can be left opened; see Application Circuit on page 8 as an example.  |
| 8, 18                             | GND              | Internal grounding; can be grounded or left open on PCB                                                                                                         |
| 12                                | RF OUT           | Output, matched to 50 ohms                                                                                                                                      |
| 9, 17                             | V <sub>d</sub>   | Drain voltage. Bias network is required; must be biased from both pins; see Application Circuit on page 8 as an example.                                        |
| 15                                | V <sub>det</sub> | Detector diode output voltage. Varies with RF output power.                                                                                                     |
| 16                                | V <sub>ref</sub> | Reference diode output voltage.                                                                                                                                 |
| 21                                | GND              | Backside Paddle. Multiple vias should be employed to minimize inductance and thermal resistance; see Mounting Configuration on page 12 for suggested footprint. |

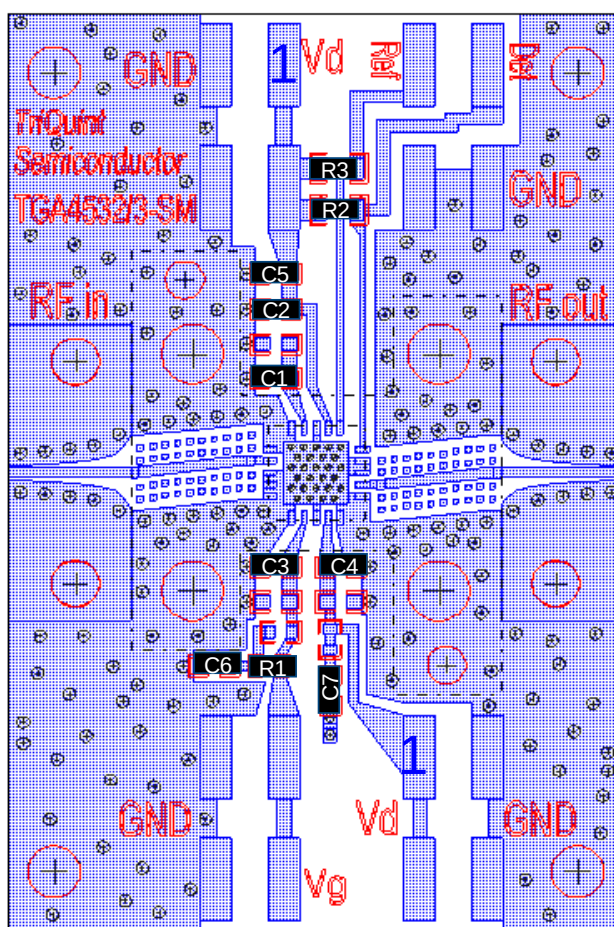
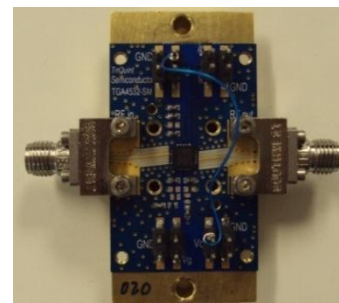
### Applications Information

#### PC Board Layout

Top RF layer is 0.008" thick Rogers RO4003,  $\epsilon_r = 3.38$ . Metal layers are 0.5-oz copper. Microstrip 50  $\Omega$  line detail: width = 0.0175".

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.

For further technical information, refer to the [TGA4533-SM](#) Product Information page.



#### Bill of Material

| Ref Des        | Value    | Description               | Manufacturer | Part Number |
|----------------|----------|---------------------------|--------------|-------------|
| C1, C2, C3, C4 | 100 pF   | Cap, 0402, 50 V, 5%, COG  | various      |             |
| C5, C6, C7     | 1 uF     | Cap, 0603, 25 V, 10%, X5R | various      |             |
| R1             | 15 Ohms  | Res, 0402, 0.1 W, 5%, SMD | various      |             |
| R2, R3         | 40K Ohms | Res, 0603, 0.1 W, 5%, SMD | various      |             |

All dimensions are in millimeters.



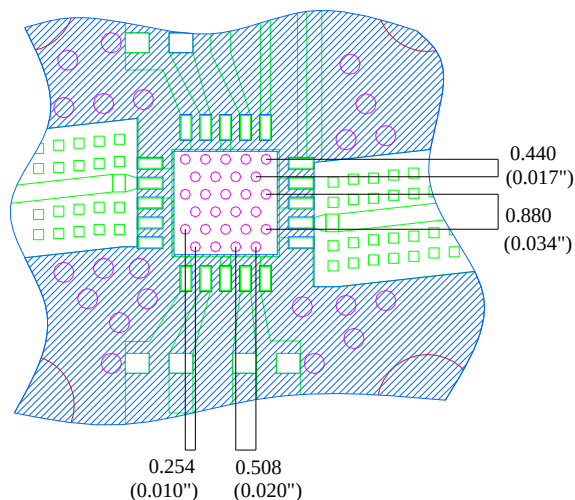
### Mechanical Information (cont.)

#### Mounting Configuration

All dimensions are in millimeters (inches).

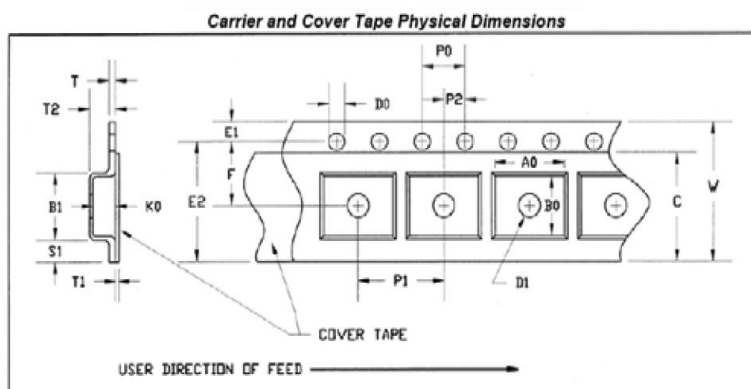
Notes:

1. A heatsink underneath the area of the PCB for the mounted device is recommended for proper thermal operation.
2. Ground / thermal vias are critical for the proper performance of this device. Vias have a final plated thru diameter of 0.254 mm (0.010").



### Tape and Reel Information

Tape and reel specifications for this part are also available on the TriQuint website in the “Application Notes” section.  
Standard T/R size = 500 pieces on a 7 x 0.5” reel.



### CARRIER AND COVER TAPE DIMENSIONS

| Part                        | Feature                                | Symbol | Size (in) | Size (mm) |
|-----------------------------|----------------------------------------|--------|-----------|-----------|
| Cavity                      | Length                                 | A0     | 0.171     | 4.35      |
|                             | Width                                  | B0     | 0.171     | 4.35      |
|                             | Depth                                  | K0     | 0.043     | 1.1       |
|                             | Pitch                                  | P1     | 0.315     | 8.0       |
| Distance Between Centerline | Cavity to Perforation Length Direction | P2     | 0.079     | 2.0       |
|                             | Cavity to Perforation Width Direction  | F      | 0.217     | 5.5       |
| Cover Tape                  | Width                                  | C      | 0.374     | 9.5       |
| Carrier Tape                | Width                                  | W      | 0.472     | 12.0      |

### Product Compliance Information

#### ESD Information



**Caution! ESD-Sensitive Device**

ESD Rating: Class 1A  
Value:  $\geq 250\text{V}$  and  $\leq 500\text{V}$   
Test: Human Body Model (HBM)  
Standard: JEDEC Standard JESD22-A114

#### MSL Rating

Level 1 at +260 °C convection reflow  
The part is rated Moisture Sensitivity Level 1 at 260°C per JEDEC standard IPC/JEDEC J-STD-020.

#### ECCN

US Department of Commerce EAR99

#### Solderability

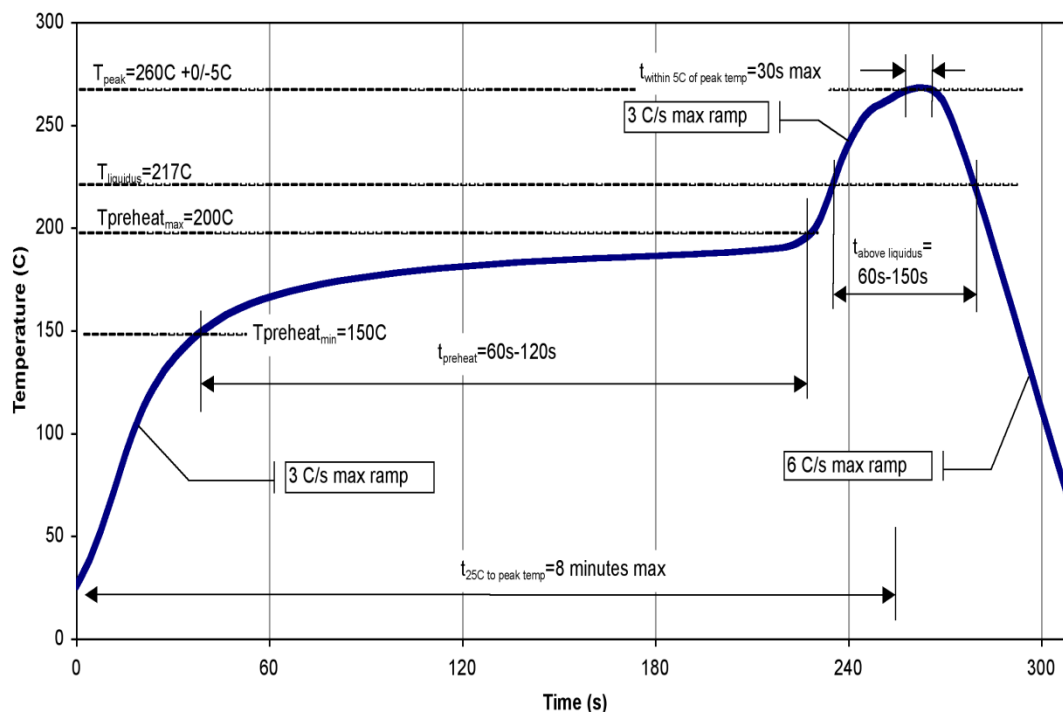
Compatible with the latest version of J-STD-020, Lead free solder, 260°

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 ( $\text{C}_{15}\text{H}_{12}\text{Br}_4\text{O}_2$ ) Free
- PFOS Free
- SVHC Free

### Recommended Soldering Temperature Profile



# TGA4533-SM

## K-Band Power Amplifier



### Contact Information

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

Web: [www.triquint.com](http://www.triquint.com)  
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Tel: +1.972.994.8465  
Fax: +1.972.994.8504

For technical questions and application information:

Email: [info-networks@tqs.com](mailto:info-networks@tqs.com)

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