

Applications

- VSAT
- Point-to-Point Radio
- Test Equipment & Sensors

Product Features

- Frequency Range: 28 – 31 GHz
- Power: 23 dBm P1dB
- Gain: 33 dB
- Output TOI: 31 dBm
- Attenuation Range: 30 dB
- Bias: $V_d = 5\text{ V}$, $I_d = 330\text{ mA}$, $V_g = -0.7\text{ V}$ Typical
- Package Dimensions: 6.0 x 6.0 x 0.85 mm

General Description

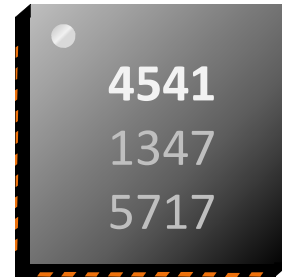
The TriQuint TGA4541-SM is a variable gain amplifier to be used as a driver amplifier in linear Ka band applications. The TGA4541-SM operates from 28 to 31 GHz and is designed using TriQuint's pHEMT production process.

The TGA4541-SM typically provides 23 dBm of linear power with 32 dB of small signal gain and 31 dBm of output TOI. The attenuation range is typically 30 dB.

The TGA4541-SM is available in a low-cost, surface mount 40 lead 6x6 QFN package and is ideally suited for VSAT ground terminals and Point-to-Point Radio applications.

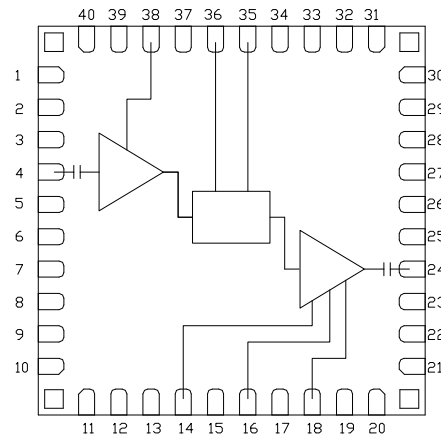
Lead-free and RoHS compliant.

Evaluation Boards are available upon request.



QFN 6x6mm 40L

Functional Block Diagram



Pin Configuration

| Pin # | Symbol |
|--|--------|
| 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 17, 19, 20, 21, 22, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 37, 39, 40 | N/C |
| 4 | RF IN |
| 14 | Vg |
| 16 | Vd2 |
| 18 | Vd3 |
| 24 | RF OUT |
| 35 | Vc |
| 36 | Gnd |
| 38 | Vd1 |

Ordering Information

| Part No. | ECCN | Description |
|------------|-------|---------------------------|
| TGA4541-SM | EAR99 | Ka-band Variable Gain Amp |

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

Specifications

Absolute Maximum Ratings

| Parameter | Rating |
|-----------------------------------|---------------|
| Drain Voltage, Vd | +6 V |
| Drain Current, Id1 | 96 mA |
| Drain Current, Id2+Id3 | 672 mA |
| Power Dissipation, Pdiss | 4.0 W |
| RF Input Power, CW, 50Ω, T = 25°C | +20 dBm |
| Channel Temperature, Tch | 200 °C |
| Mounting Temperature (30 Seconds) | 260 °C |
| Storage Temperature | -40 to 150 °C |

Recommended Operating Conditions

| Parameter | Min | Typical | Max | Units |
|-----------|-----|---------|-----|-------|
| Vd | | 5 | | V |
| Id1 | | 60 | | mA |
| Id2+Id3 | | 270 | | mA |
| Vg | | -0.7 | | V |

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

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.

Electrical Specifications

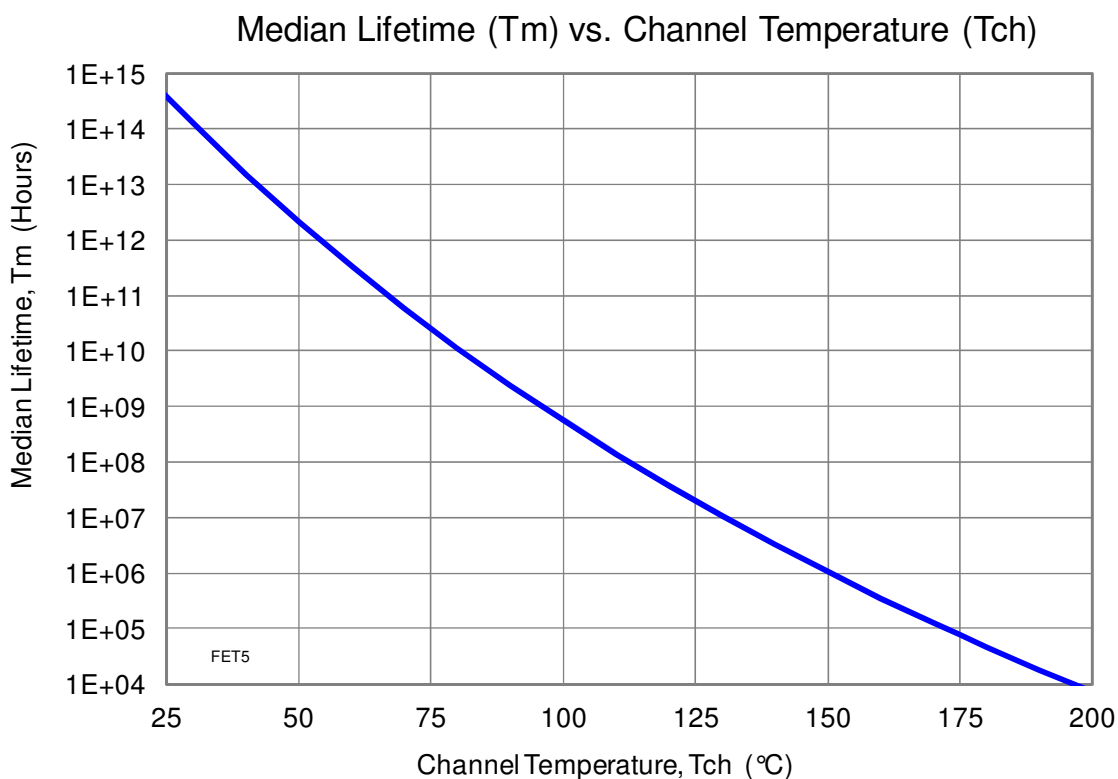
Test conditions unless otherwise noted: 25°C, Vd = 5 V, Id1 = 60 mA, Id2+Id3 = 270 mA, Vc = -1.0 V, Vg = -0.7 V typical. Id2+Id3 are held constant throughout the test. Z₀: 50 Ω

| Parameter | Min | Typical | Max | Units |
|---|------|---------|-----|-------|
| Operational Frequency Range | 28 | | 31 | GHz |
| Gain: | | | | |
| 28 to < 29 GHz | 31.5 | | 42 | dB |
| 29 to < 30 GHz | 31.5 | | 40 | dB |
| 30 to 31 GHz | 26.5 | | 39 | dB |
| Attenuation Range | | 30 | | dB |
| Input Return Loss | | 18 | | dB |
| Output Return Loss | | 17 | | dB |
| Output Power @ 1dB Gain Compression (max gain): | | | | |
| 28 to < 29 GHz | | 21 | | dBm |
| 29 to < 30 GHz | | 20.5 | | dBm |
| 30 to 31 GHz | | 15 | | dBm |
| Output TOI | | 31 | | dBm |
| Gain Temperature Coefficient (max gain) | | -0.08 | | dB/°C |
| Power Temperature Coefficient (max gain) | | -0.008 | | dB/°C |

Specifications

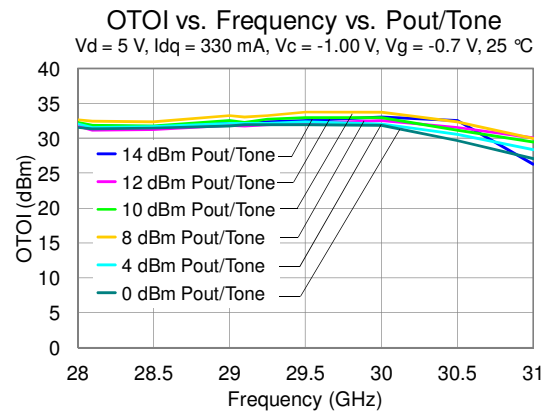
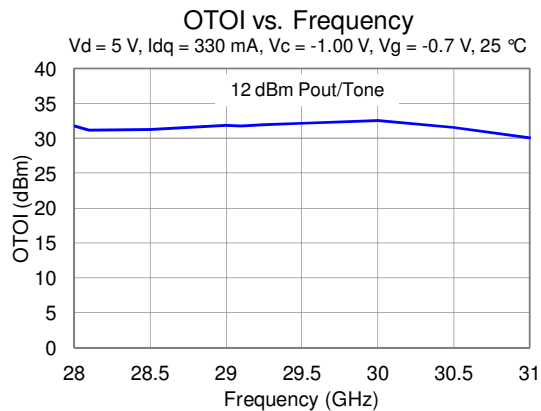
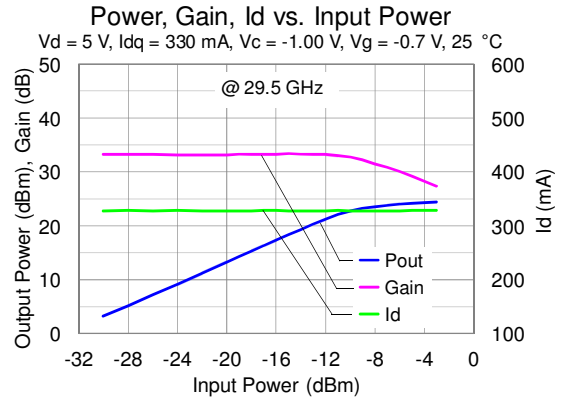
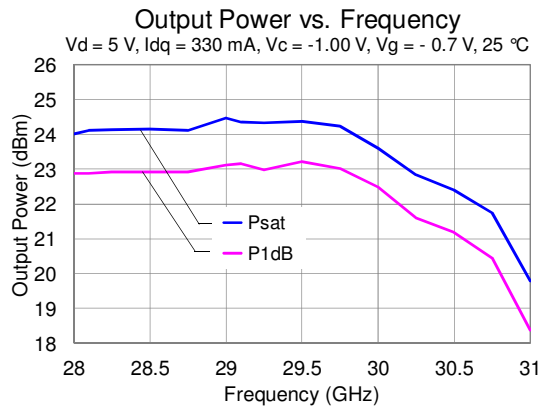
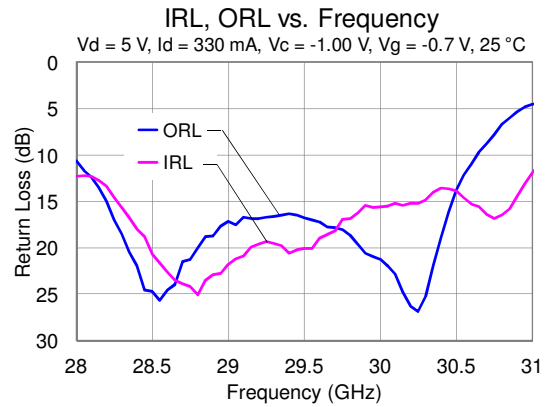
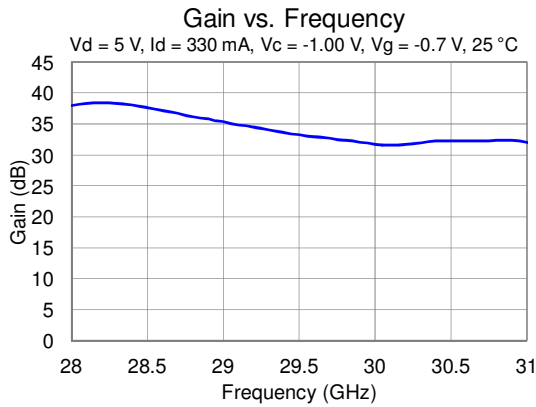
Thermal and Reliability Information

| Parameter | Condition | Rating |
|--|---|--|
| Thermal Resistance, θ_{JC} , measured to back of package | Tbase = 85 °C | $\theta_{JC} = 34.5 \text{ } ^\circ\text{C/W}$ |
| Channel Temperature (Tch), and Median Lifetime (Tm) | Tbase = 85 °C, Vd = 5 V, Id = 330 mA, Pdiss = 1.65 W | Tch = 142 °C Tm = 2.8 E+6 Hours |
| Channel Temperature (Tch), and Median Lifetime (Tm) Under RF Drive | Tbase = 85 °C, Vd = 5 V, Id = 330 mA, Pout = 24 dBm, Pdiss = 1.40 W | Tch = 133 °C Tm = 7.9 E+6 Hours |



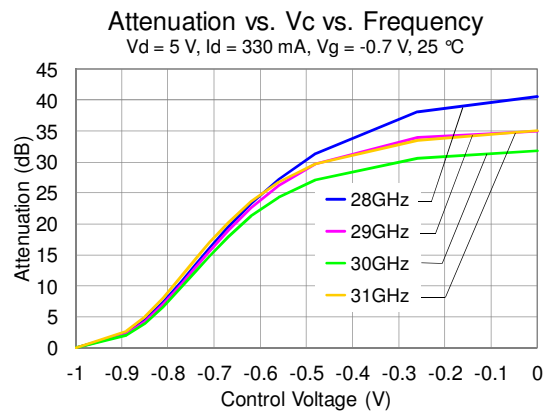
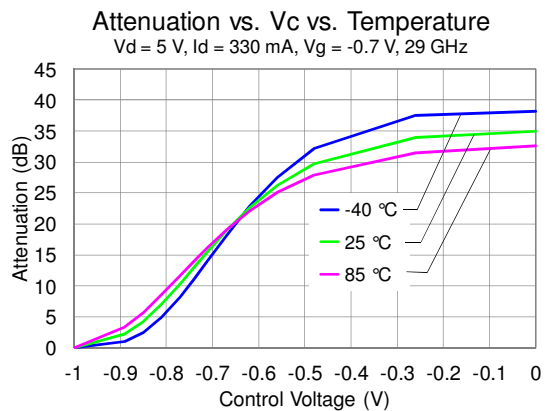
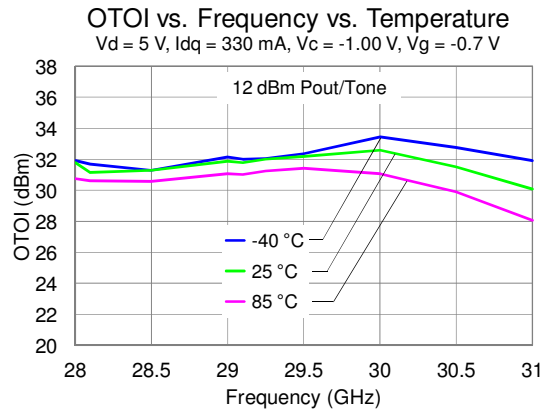
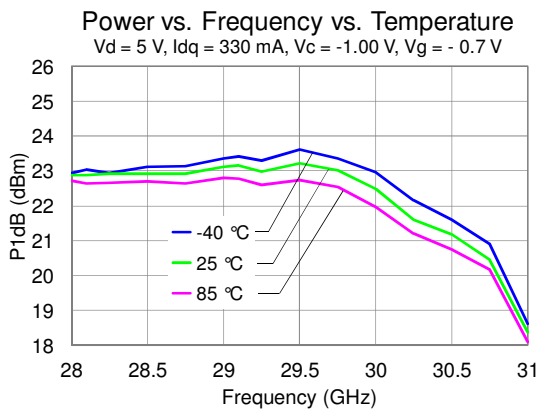
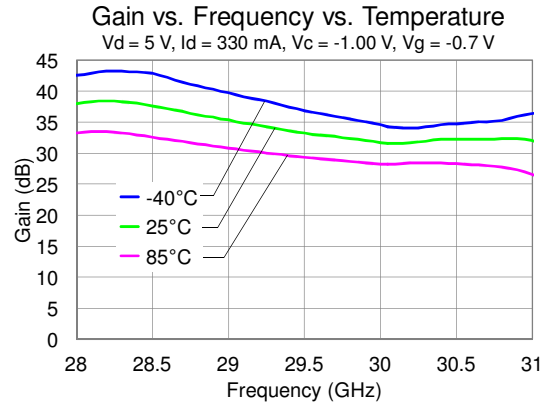
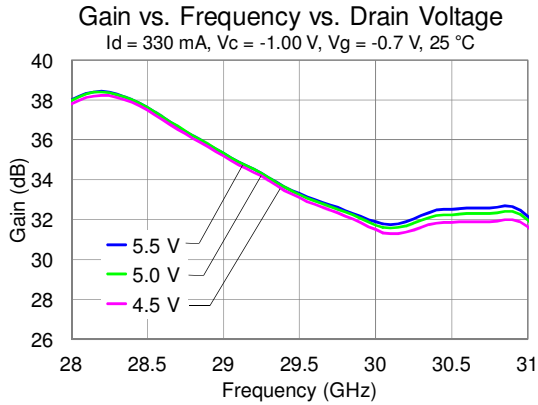
Typical Performance

Id2+Id3 are held constant throughout the test.



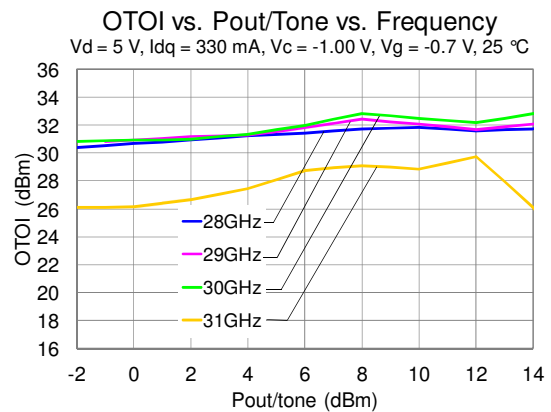
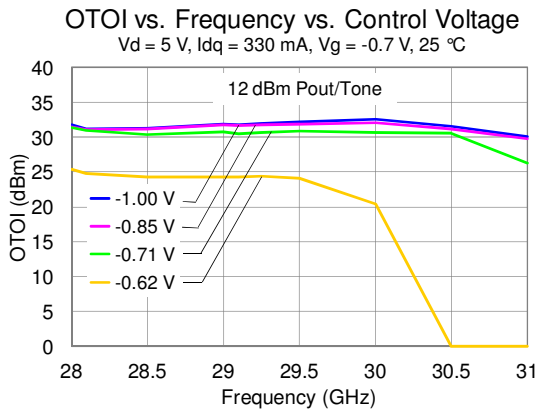
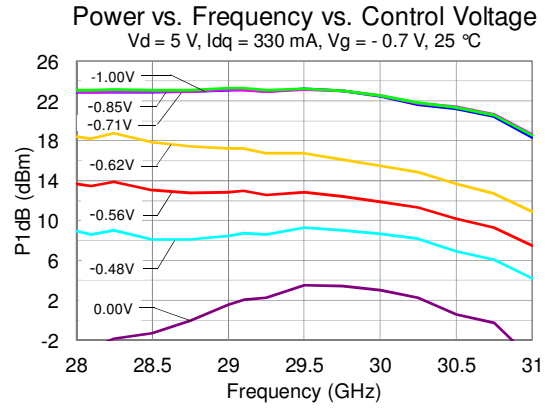
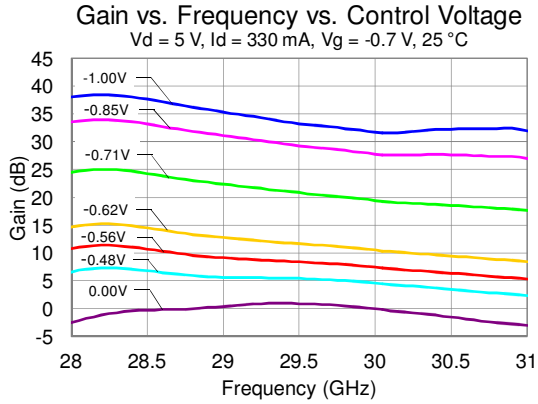
Typical Performance

$I_{d2}+I_{d3}$ are held constant throughout the test.

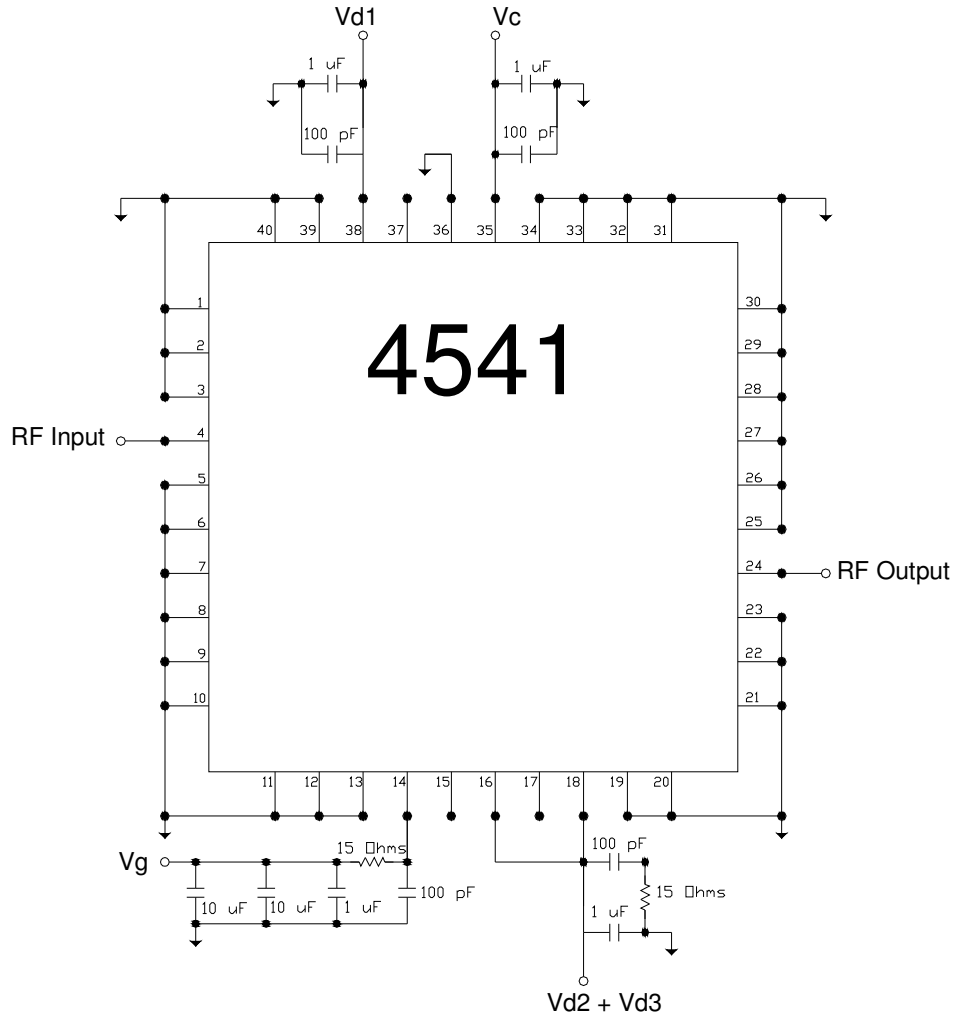


Typical Performance

$I_{d2}+I_{d3}$ are held constant throughout the test.

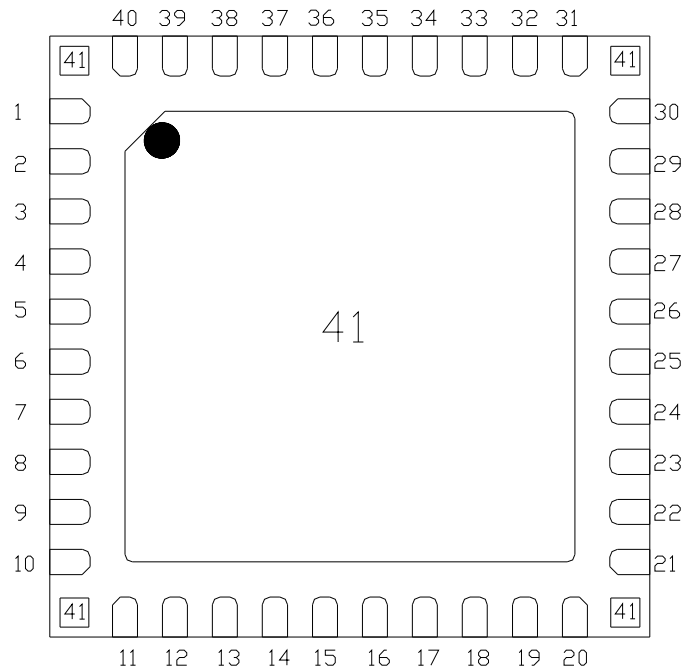


Application Circuit



| Bias-up Procedure | Bias-down Procedure |
|---|-----------------------|
| Set Vg to -1.5 V | Turn off RF supply |
| Set Vd1 to 5 V | Reduce Vg to -1.5 V |
| Set Vd2+Vd3 to 5 V | Set Vc to 0 V |
| Set Vc to -1.00 V | Reduce Vd2+Vd3 to 0 V |
| Adjust Vg more positive until quiescent $I_{d2}+I_{d3} = 270$ mA, $I_{d1} = 60$ mA, $V_g \sim -0.7$ V typical | Reduce Vd1 to 0 V |
| Apply RF signal | |
| Vd1 and Vd2+Vd3 should be separately monitored. | |

Pin Description



Top View

| Pin | Symbol | Description |
|--|--------|---|
| 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 19, 20, 21, 22, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 39, 40 | N/C | No internal connection; must be grounded on PCB. |
| 4 | RF IN | RF Input. |
| 14 | Vg | Gate voltage. Bias network is required; see Application Circuit on page 7 as an example. |
| 15, 17, 37 | N/C | No internal connection; should be left open. |
| 16 | Vd2 | Drain voltage. Bias network is required; see Application Circuit on page 7 as an example. |
| 18 | Vd3 | Drain voltage. Bias network is required; see Application Circuit on page 7 as an example. |
| 24 | RF OUT | RF Output. |
| 35 | Vc | Control voltage. Bias network is required; see Application Circuit on page 7 as an example. |
| 36 | GND | Internally grounded through a resistor; must be grounded on PCB. |
| 38 | Vd1 | Drain voltage. Bias network is required; see Application Circuit on page 7 as an example. |
| 41 | GND | Backside paddles; must be grounded on PCB. Multiple vias should be employed to minimize inductance and thermal resistance; see Mounting Configuration on page 12 for suggested footprint. |

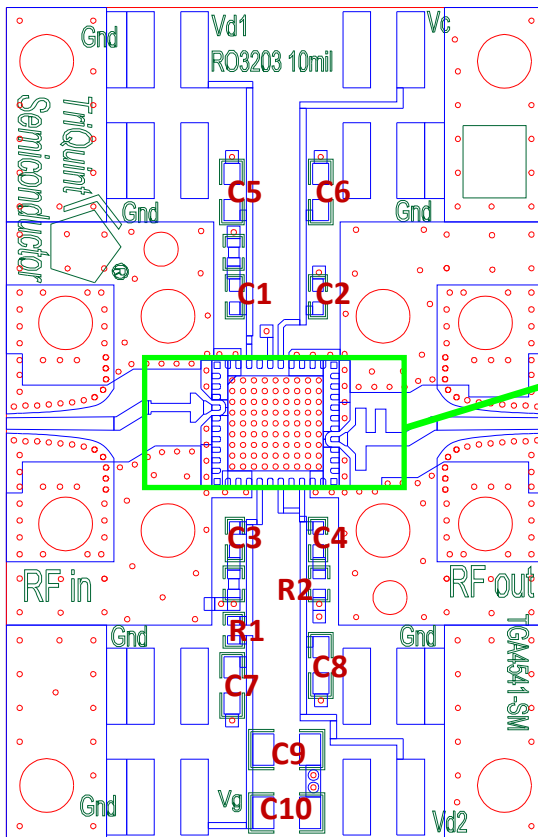
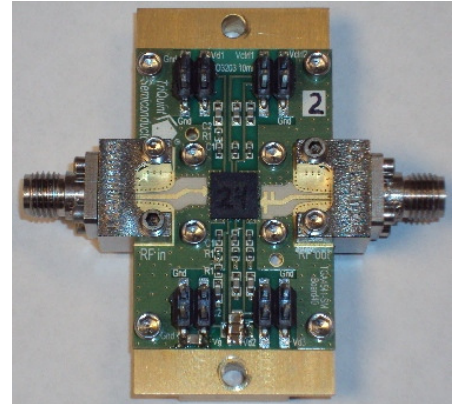
Applications Information

PC Board Layout

Top RF layer is 0.010" thick Rogers RO3203, $\epsilon_r = 3.02$. Metal layers are 1/2-oz copper.

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 [TGA4541-SM](#) Product Information page.



Detail is on the next page

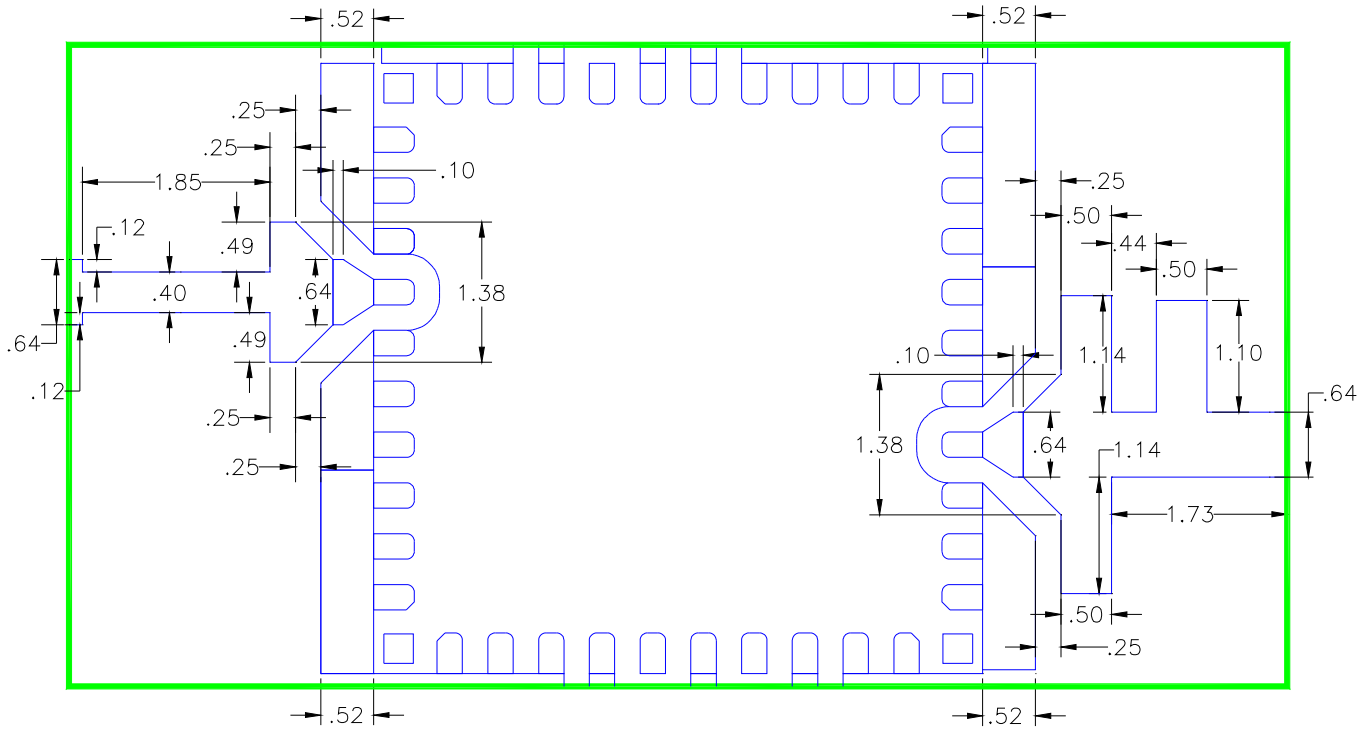
Bill of Materials

| Ref Des | Value | Description | Manufacturer | Part Number |
|----------|-------------|-------------------------|--------------|-------------|
| C1- C4 | 100 pF | Cap, 0402, 20V, 5%, COG | various | |
| C5 - C8 | 1 μ F | Cap, 0603, 25V, 5%, X5R | various | |
| C9 - C10 | 10 μ F | Cap, 0805, 25V, 5%, X5R | various | |
| R1- R2 | 15 Ω | Res, 0402, 0.1W, SMD | various | |

Applications Information

PC Board Tuning Layout

Dimensions are in millimeters.



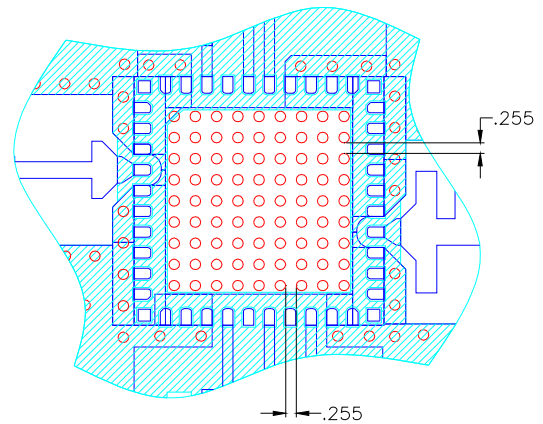
Mechanical Information

Mounting Configuration

All dimensions are in millimeters.

Notes:

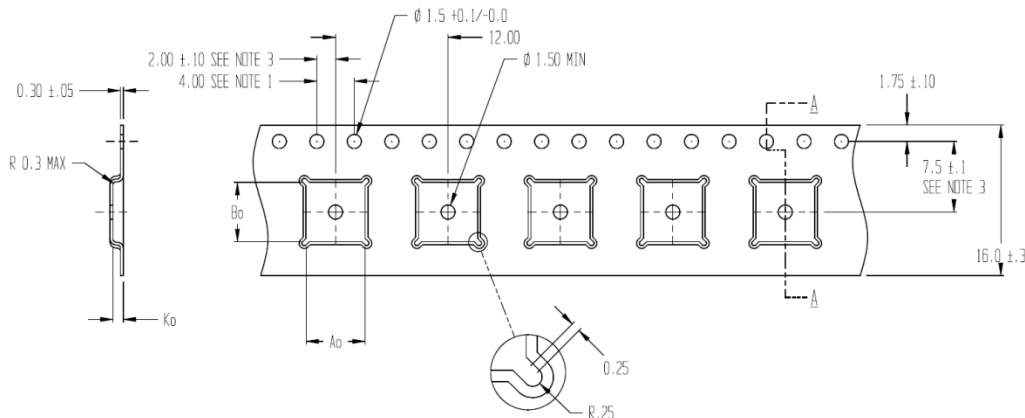
1. Ground vias are critical for the proper performance of this device. Vias have a drill diameter of 0.25 mm.



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 | 0.248 | 6.3 |
| | Width | B0 | 0.248 | 6.3 |
| | Depth | K0 | 0.043 | 1.1 |
| | Pitch | P1 | 0.472 | 12.0 |
| Distance Between Centerline | Cavity to Perforation Length Direction | P2 | 0.079 | 2.0 |
| | Cavity to Perforation Width Direction | F | 0.295 | 7.5 |
| Cover Tape | Width | C | 0.561 | 14.25 |
| Carrier Tape | Width | W | 0.63 | 16.0 |

Product Compliance Information

ESD Information



Caution! ESD-Sensitive Device

ESD Rating: Class 0
 Value: < 250 V
 Test: Human Body Model (HBM)
 Standard: JEDEC Standard JESD22-A114

MSL Rating

Level 3 at +260 °C convection reflow
 The part is rated Moisture Sensitivity Level 3 at 260 °C per JEDEC standard IPC/JEDEC J-STD-020.

Solderability

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

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

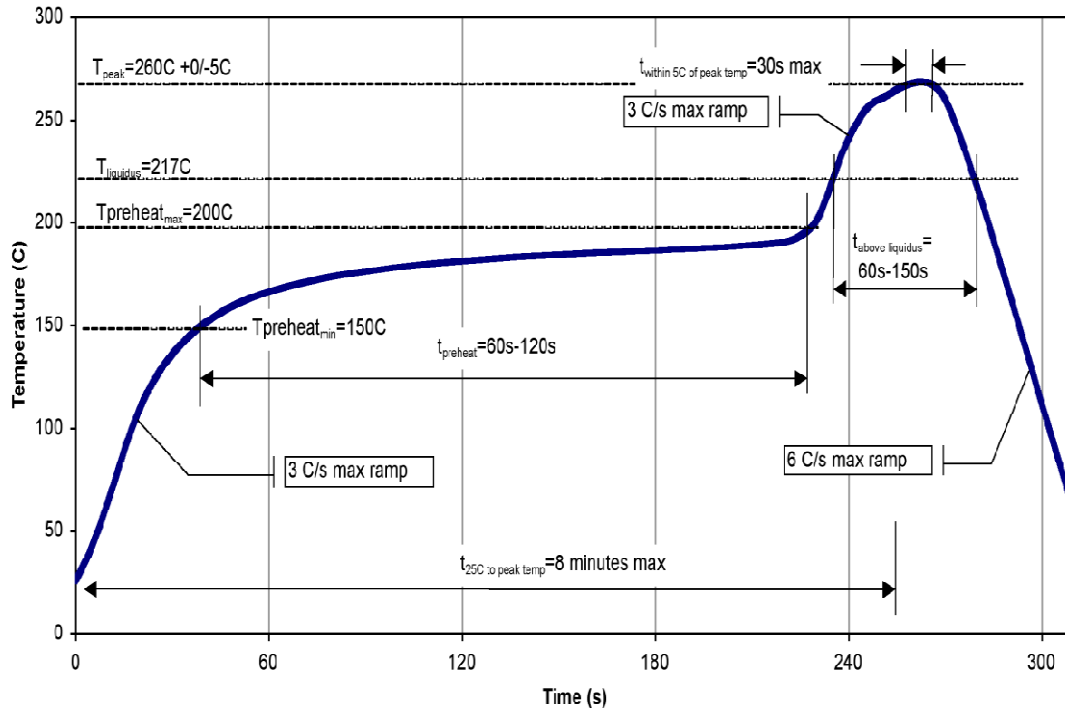
This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C₁₅H₁₂Br₄O₂) Free
- PFOS Free
- SVHC Free

ECCN

US Department of Commerce EAR99

Recommended Soldering Temperature Profile



Contact Information

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

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