

Product Overview

The Qorvo TGA2533-SM is a Ku-Band Packaged Power Amplifier. The TGA2533-SM operates from 12.5 to 15.5 GHz and is designed using Qorvo's power pHEMT production process.

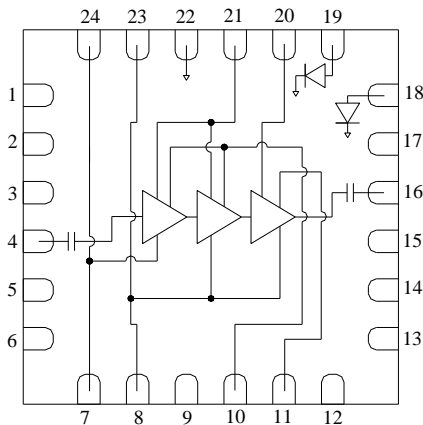
The TGA2533-SM typically provides 43dBm of TOI at 20dBm Pout/Tone, 33 dBm of output power at 1dB gain compression, and the small signal gain is 27 dB.

The TGA2533-SM is available in a low-cost, surface mount 24 lead 5x5 QFN package and is ideally suited for Point-to-Point Radio, and Ku-Band VSAT Ground Terminal.

Lead-free and RoHS compliant.

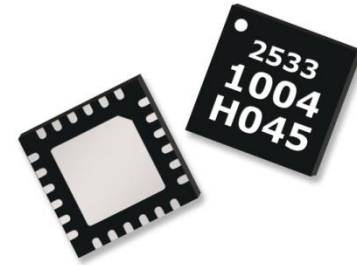
Evaluation Boards are available upon request.

Functional Block Diagram



Pin Configuration

| Pin # | Symbol |
|--------------------------------------|--------|
| 1, 2, 3, 5, 6, 9, 12, 13, 14, 15, 17 | N/C |
| 4 | RF IN |
| 7, 8, 23, 24 | Vg |
| 16 | RF OUT |
| 10, 11, 20, 21 | Vd |
| 18 | Vref |
| 19 | Vdet |
| 22 | GND |



24 Pin 5x5mm QFN Package

Key Features

- Frequency Range: 12 – 15.5 GHz
- TOI: 43 dBm
- Power: 34.5 dBm Psat, 33 dBm P1dB
- Gain: 27 dB
- Return Loss: 13 dB
- Integrated Power Detector
- Bias: Vd = 6 V, Id = 1.3 A, Vg = -0.55 V Typical
- Package Dimensions: 5.0 x 5.0 x 0.85 mm

Applications

- Point-to-Point Radio
- Ku-Band VSAT

Ordering Information

| Part No. | Description |
|-----------------------|--------------------------|
| TGA2533-SM T/R | 7" Reel with 1000 pieces |
| TGA2533-SM Eval Board | Evaluation Board |
| TGA2533-XCC-500-SM | 7" Reel with 500 pieces |

Absolute Maximum Ratings

| Parameter | Rating |
|--|---------------|
| Drain Voltage, Vd | +8 V |
| Gate Voltage, Vg | -3 to 0 V |
| Drain Current, Id | 2.24 A |
| Gate Current, Ig | -11 to 90 mA |
| Power Dissipation, Pdiss | 17.9 W |
| RF Input Power, CW, 50 Ω , T=+25 °C | +27 dBm |
| Channel Temperature, Tch | 200 °C |
| Mounting Temperature | 260 °C |
| Storage Temperature | -40 to 150 °C |

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device.

Recommended Operating Conditions

| Parameter | Min | Typ | Max | Units |
|---------------------------|-----|-------|-----|-------|
| Vd | | 6 | 7.5 | V |
| Id | | 1.3 | | A |
| Id_drive (Under RF Drive) | | 1.7 | | A |
| Vg | | -0.55 | | V |

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions. Application of conditions to the device outside the Recommended Operating Conditions may reduce device reliability and performance.

Electrical Specifications

| Parameter | Min | Typical | Max | Units |
|--------------------------------------|------|---------|------|--------|
| Operational Frequency Range | 12.5 | | 15.5 | GHz |
| Gain 12.7 – 13.3 GHz | 24 | 27 | | dB |
| 14.4 – 15.4 GHz | 25 | 27 | | dB |
| Input Return Loss | | -13 | | dB |
| Output Return Loss | | -13 | | dB |
| Output Power @ Saturation | | 34.5 | | dBm |
| Output Power @ 1 dB Gain Compression | | | | |
| 12.7 – 13.3 GHz | 32 | 33 | | dBm |
| 14.4 – 15.4 GHz | 31 | 33 | | dBm |
| Output TOI @ Pout/Tone = 20 dBm | | | | |
| 12.7 – 13.3 GHz | 39.5 | 43 | | dBm |
| 14.4 – 15.4 GHz | 39.5 | 43 | | dBm |
| Noise Figure | | 7 | | dB |
| Gain Temperature Coefficient | | -0.033 | | dB/°C |
| Power Temperature Coefficient | | -0.005 | | dBm/°C |

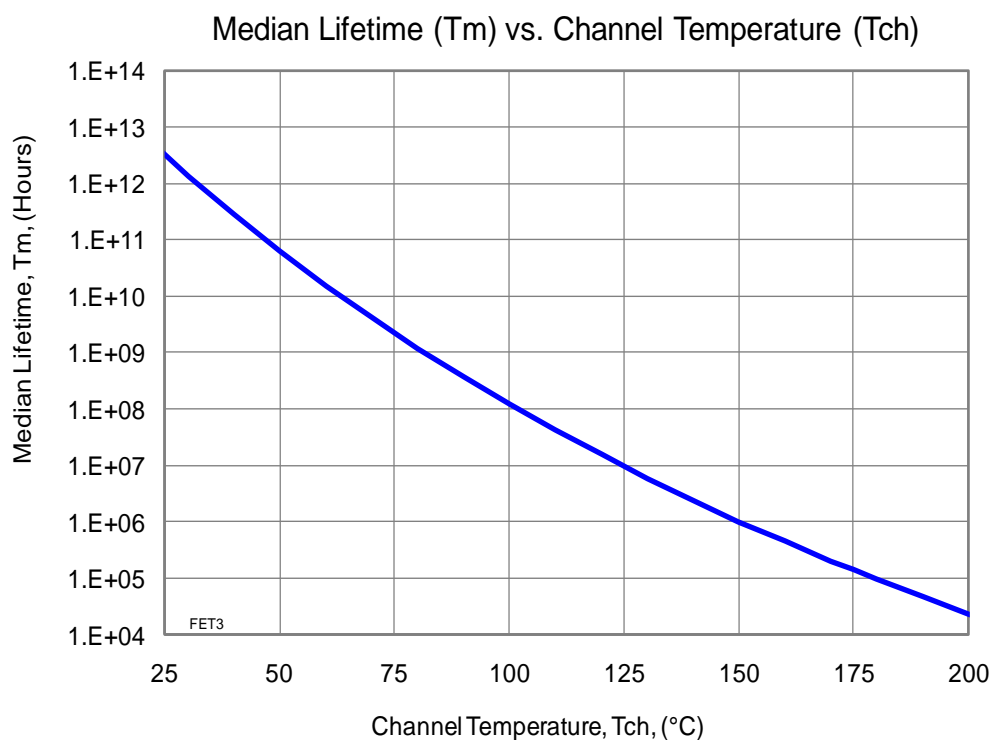
Notes:

1. Test conditions unless otherwise noted: Temp +25 °C, V_D = +6.0 V, I_d = 1.3 A, V_g = -0.55 V Typical.

Thermal and Reliability Information

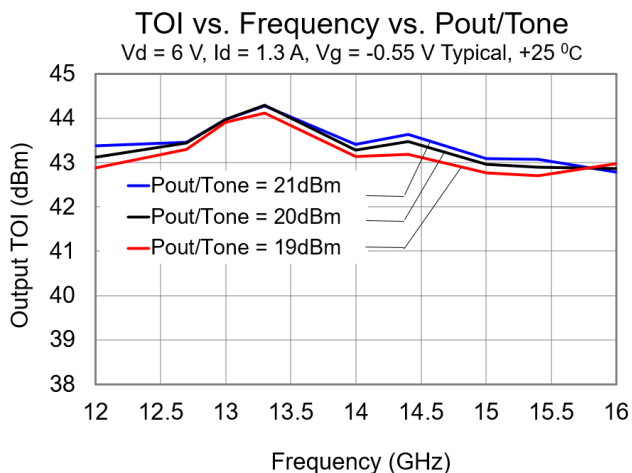
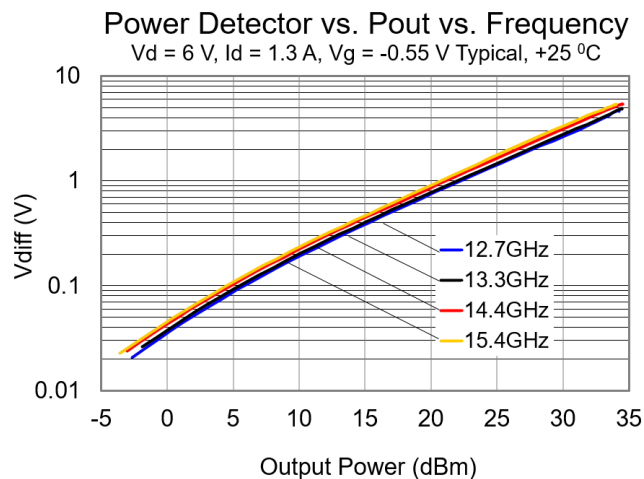
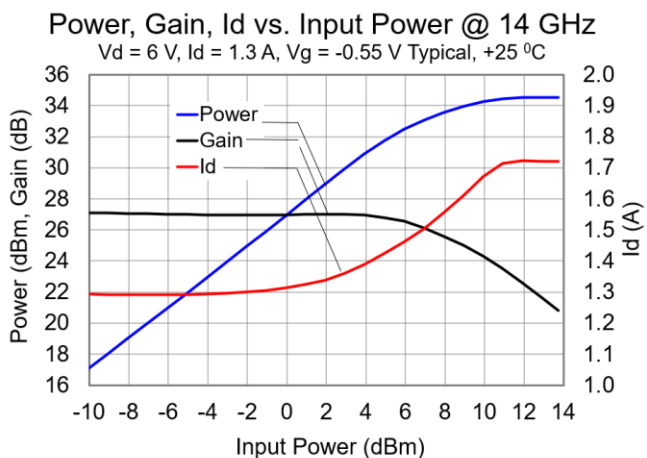
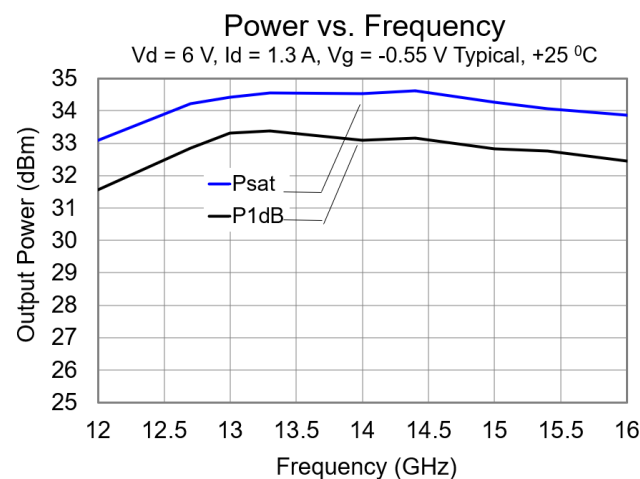
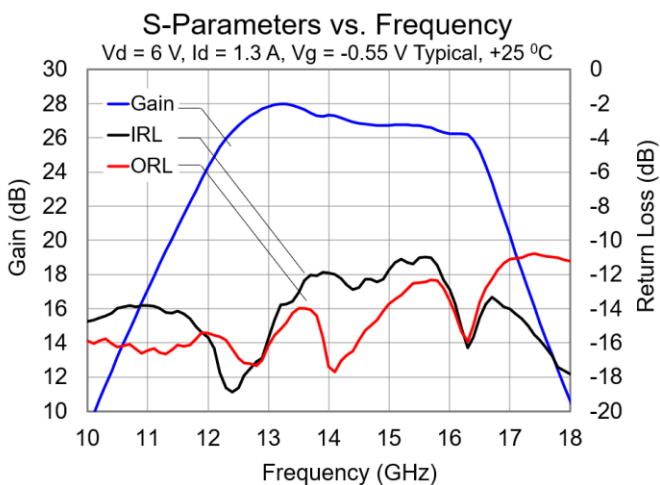
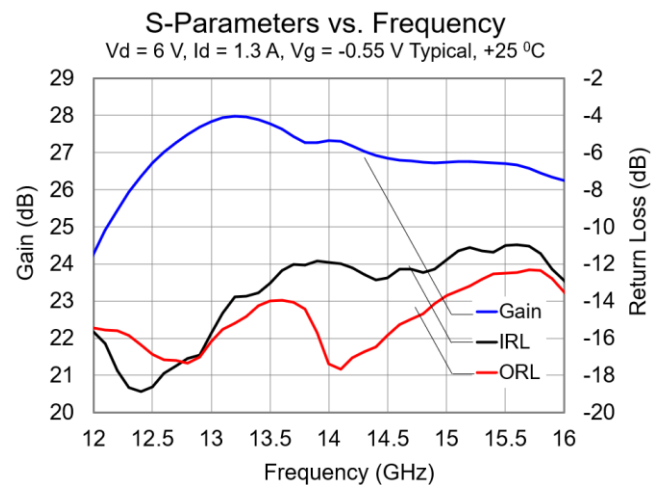
| Parameter | Condition | Rating |
|--|--|------------------------------------|
| Thermal Resistance, θ_{JC} , measured to back of package | Tbase = 85 °C | $\theta_{JC} = 5.76$ °C/W |
| Channel Temperature (Tch), and Median Lifetime (Tm) | Tbase = 85 °C, Vd = 6 V, Id = 1.3 A, Pdiss = 7.8 W | Tch = 130 °C Tm = 5.9 E+6 Hours |
| Channel Temperature (Tch), and Median Lifetime (Tm) Under RF Drive | Tbase = 85 °C, Vd = 6 V, Id = 1.7 A, Pout = 34.5 dBm, Pdiss = 7.38 W | Tch = 128 °C Tm = 1.0 E+7 Hours |

Median Lifetime



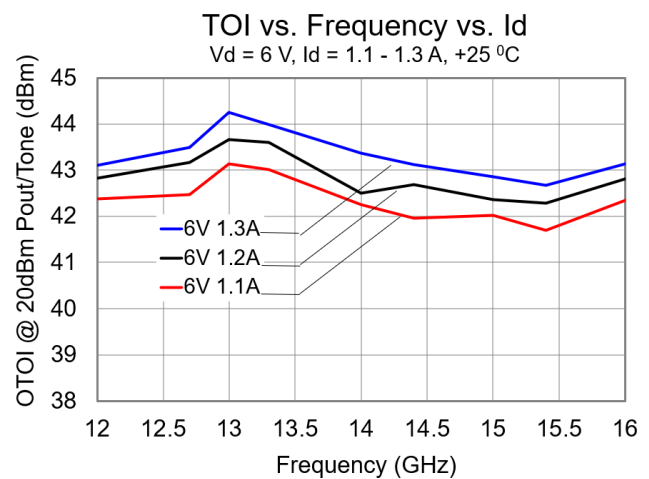
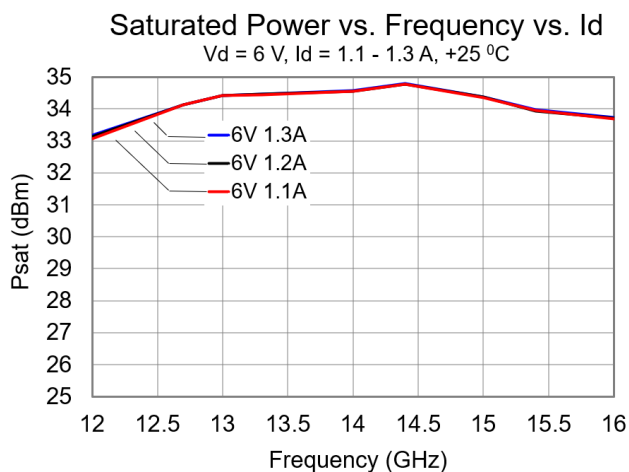
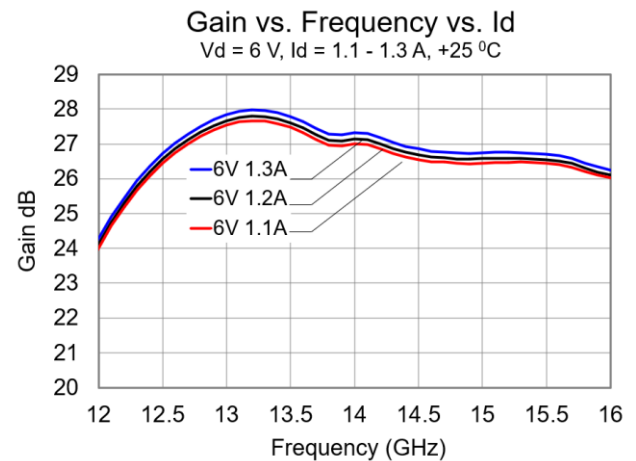
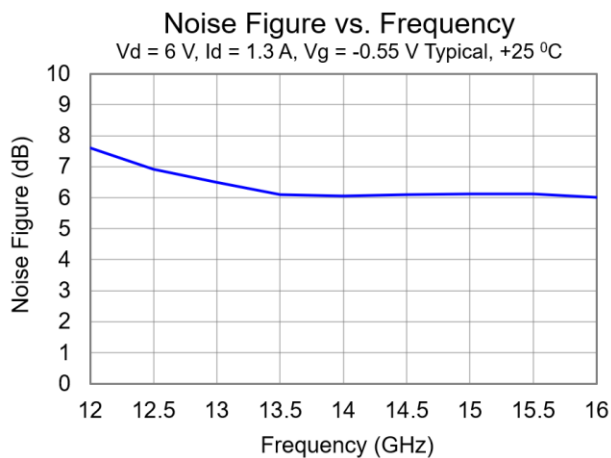
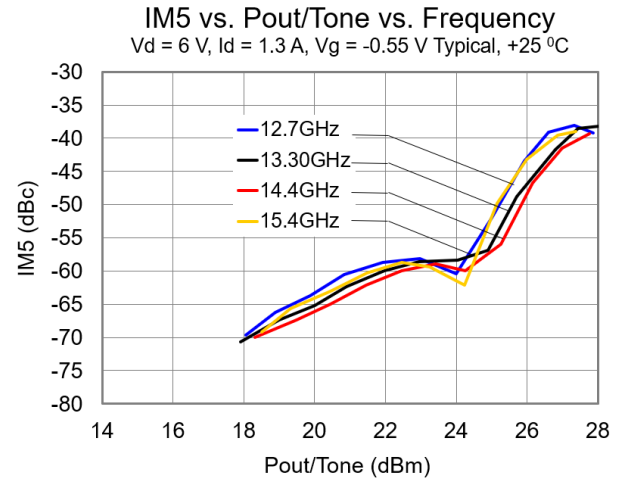
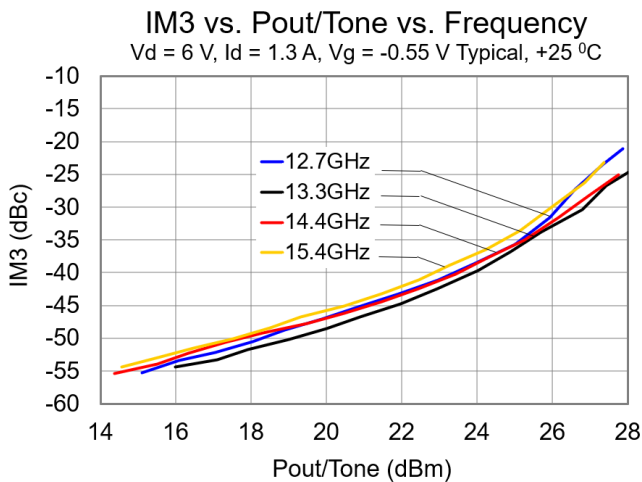
Performance Plots

Test conditions unless otherwise noted: Temp +25 °C, $V_D = +6.0$ V, $I_d = 1.3$ A, $V_g = -0.55$ V Typical, +25 °C.



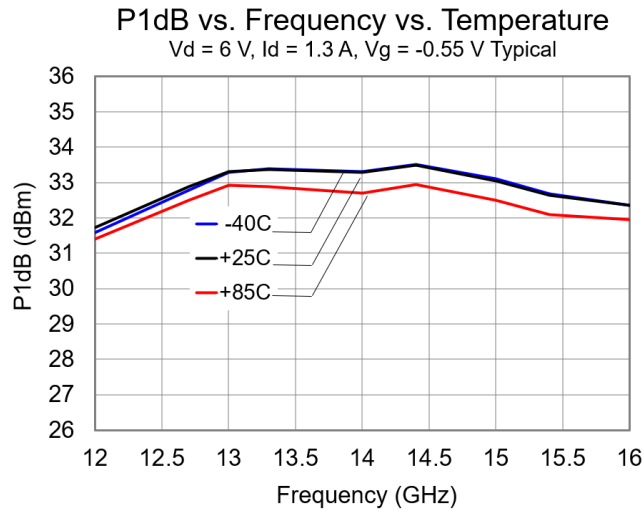
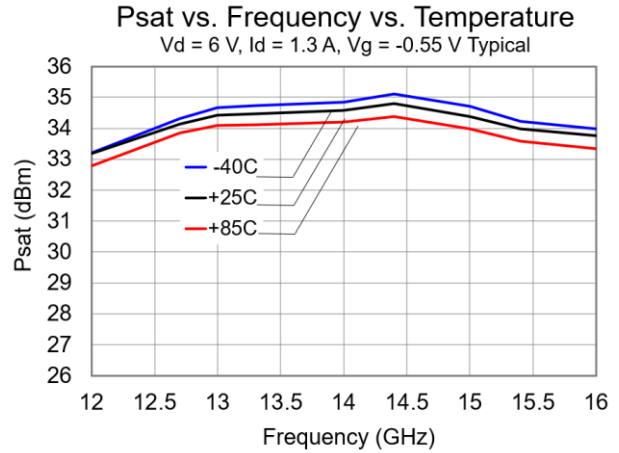
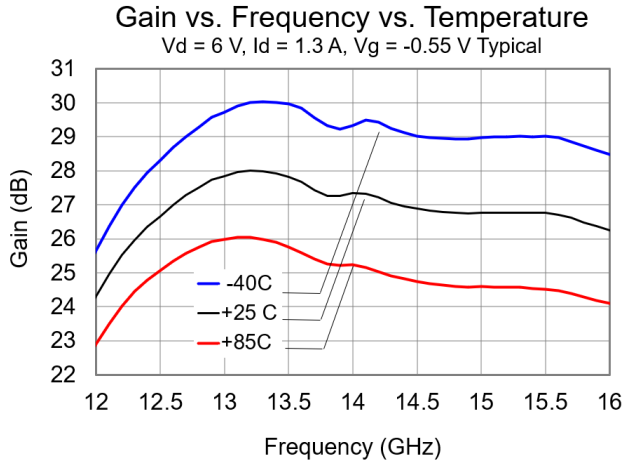
Performance Plots (cont.)

Test conditions unless otherwise noted: Temp +25 °C, $V_D = +6.0$ V, $I_d = 1.3$ A, $V_g = -0.55$ V Typical, +25 °C.

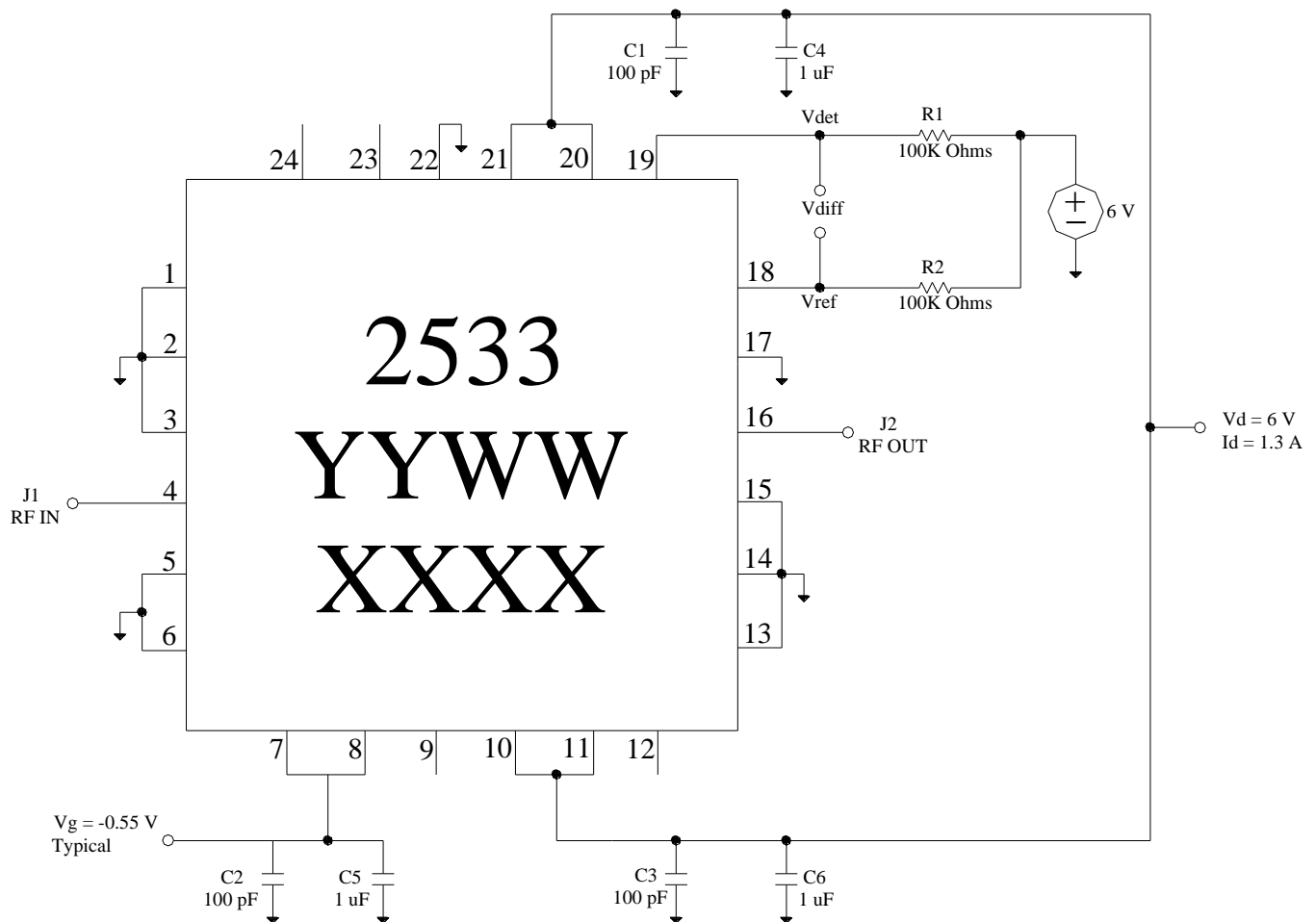


Performance Plots (cont.)

Test conditions unless otherwise noted: Temp +25 °C, $V_D = +6.0$ V, $I_d = 1.3$ A, $V_g = -0.55$ V Typical.



Application Circuit

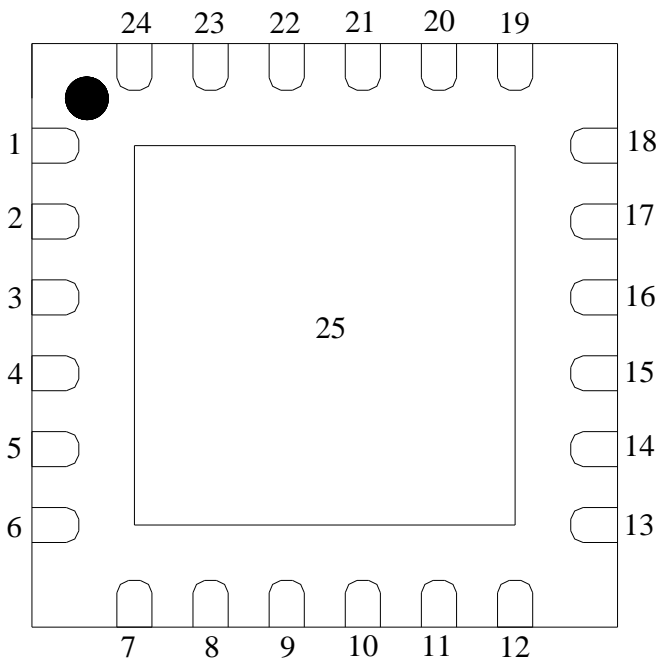


Vg can be biased from either side (pins 7 and 8 or pins 23 and 24), and the non-biased side can be left open.
Vd must be biased from both sides (pins 10, 11, 20, and 21).

| 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 1.3A. This will be ~ Vg = -0.55 V | Turn Vd to 0 V |
| Apply RF signal to RF Input | Turn Vg to 0 V |

The TGA2533-SM will be marked with the “2533” 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, and the “XXXX” is an auto-generated number.

Pin Configuration and Description



| Pin | Symbol | Description |
|-------------------------------|--------|--|
| 1, 2, 3, 5, 6, 13, 14, 15, 17 | N/C | No internal connection; must be grounded on PCB |
| 4 | RF IN | Input, matched to 50 ohms |
| 7, 8, 23, 24 | Vg | Gate voltage. ESD protection included; Bias network is required; can be biased from either side (pins 7 and 8 or pins 23 and 24), and non-biased side can be left opened; see Application Circuit on page 7 as an example. |
| 9, 12 | N/C | No internal connection. Can be grounded on PCB or left open |
| 10, 11, 20, 21 | Vd | Drain voltage. Bias network is required; must be biased from both sides; see Application Circuit on page 7 as an example. |
| 16 | RF OUT | Output, matched to 50 ohms |
| 18 | Vref | Reference diode output voltage. |
| 19 | Vdet | Detector diode output voltage. Varies with RF output power. |
| 22 | GND | Internal grounding; can be grounded on PCB or left open |
| 25 | GND | Backside Paddle. Multiple vias should be employed to minimize inductance and thermal resistance; see PCB Mounting Pattern on page 11 for suggested footprint. |



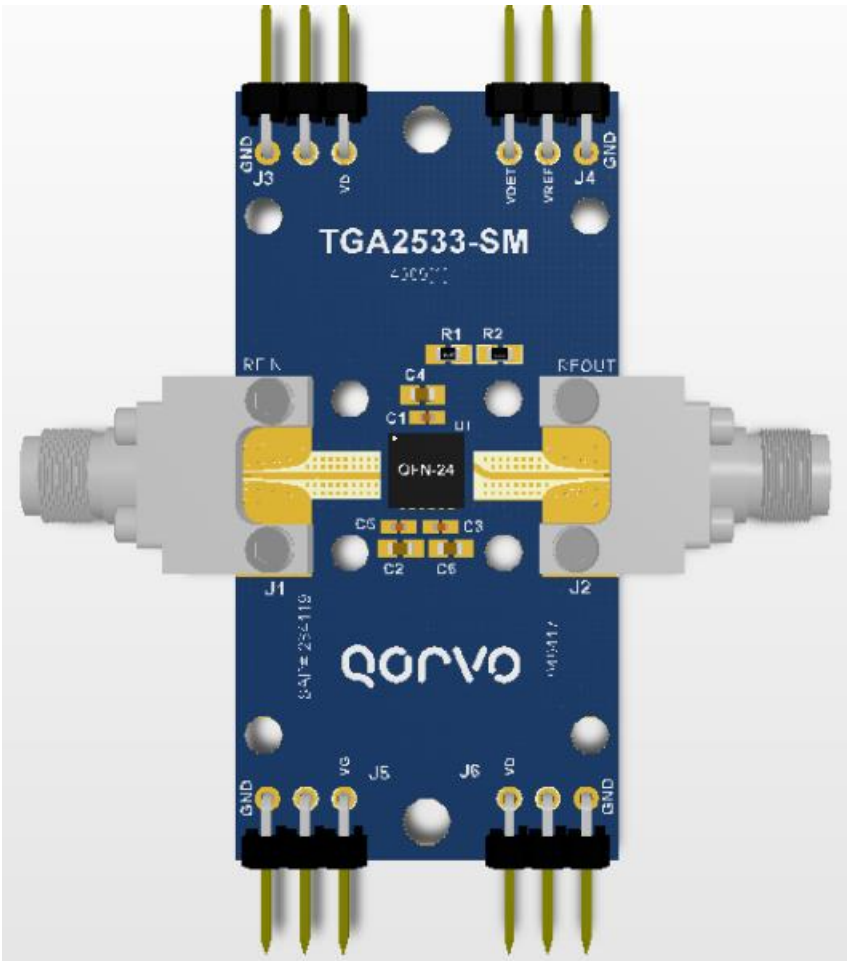
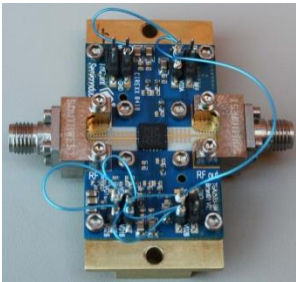
TGA2533-SM
Ku-Band Power Amplifier

Evaluation Board PCB Information

Top RF layer is 0.008" thick Rogers RO4003, $\epsilon_r = 3.38$. Metal layers are 1-oz copper. Microstrip 50 Ω line detail: width = 0.0175".

The pad pattern shown has been developed and tested for optimized assembly at Qorvo (formerly 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.

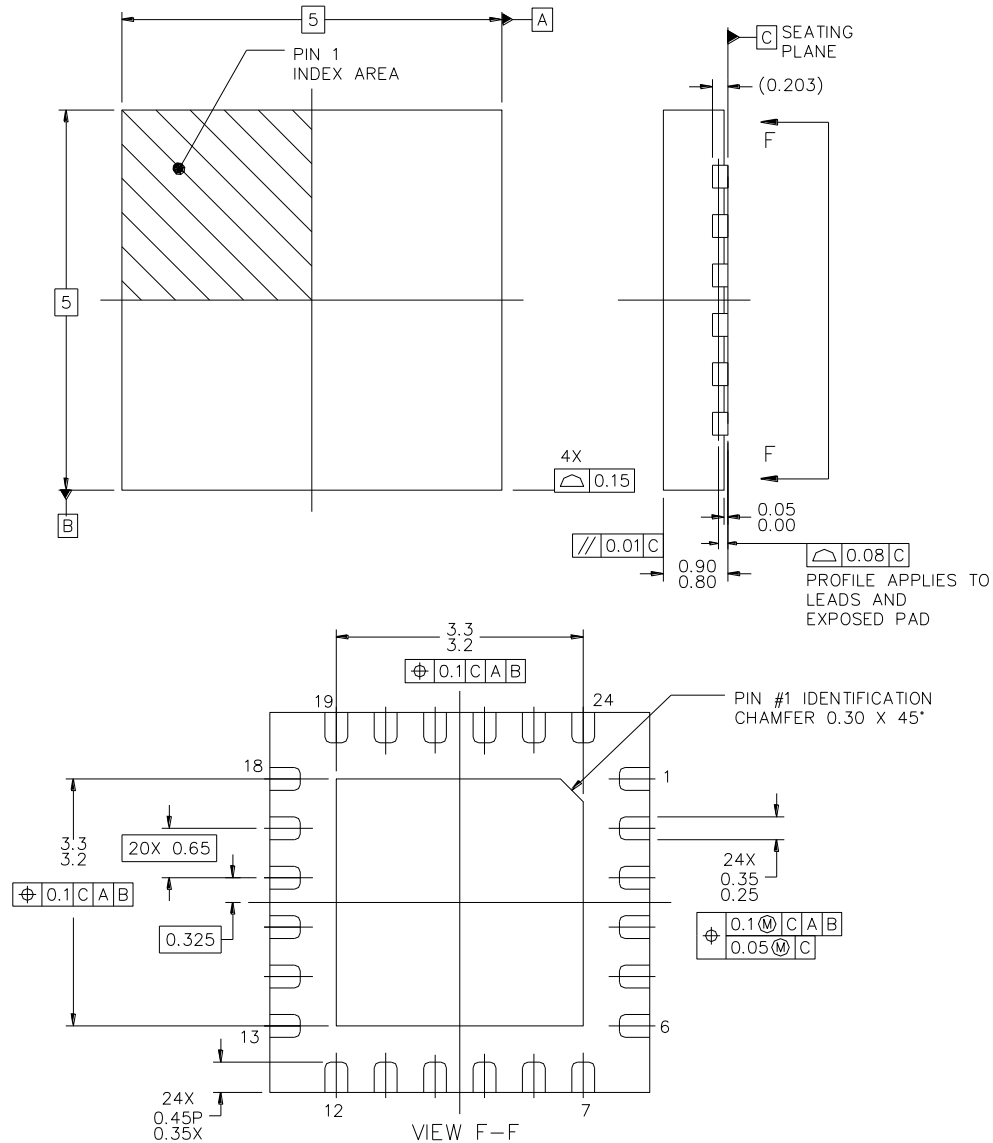
For further technical information, refer to the [TGA2533-SM](#) Product Information page.



Bill of Materials

| Ref Des | Value | Description | Manufacturer | Part Number |
|------------|-----------|---------------------------|--------------|-------------|
| C1, C2, C3 | 100 pF | Cap, 0402, 50 V, 5%, COG | various | |
| C4, C5, C6 | 1 uF | Cap, 0603, 25 V, 5%, X5R | various | |
| R1, R2 | 100K Ohms | Res, 0603, 1/16W, 5%, SMD | various | |

Mechanical Drawings & Dimensions

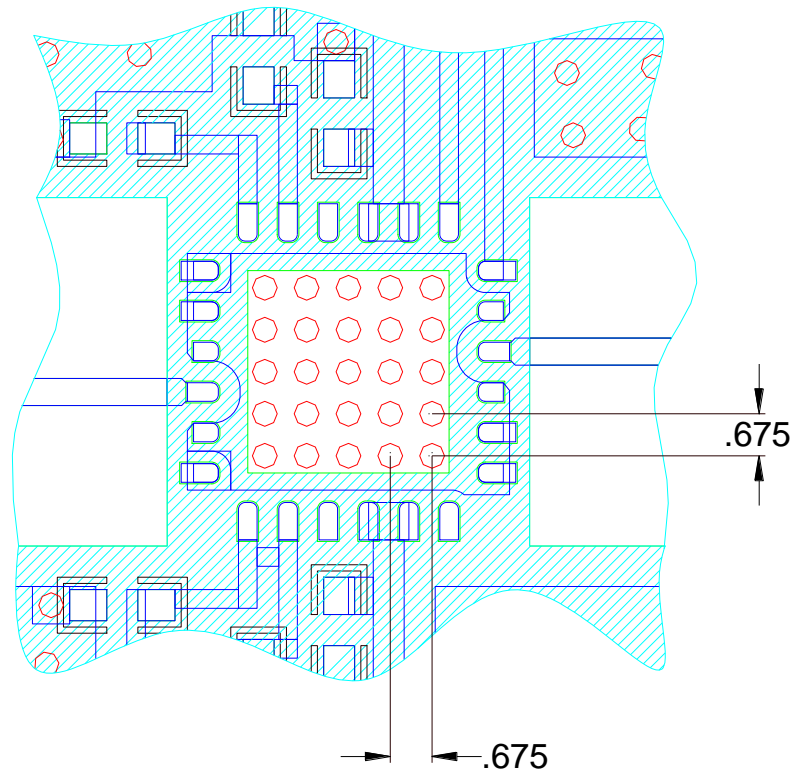


This package is lead-free/RoHS-compliant with a copper alloy base (CDA194), and the plating material on the leads is 100% matte Sn. It is compatible with both lead-free (maximum 260 °C reflow temperature) and tin-lead (maximum 245 °C reflow temperature) soldering processes.

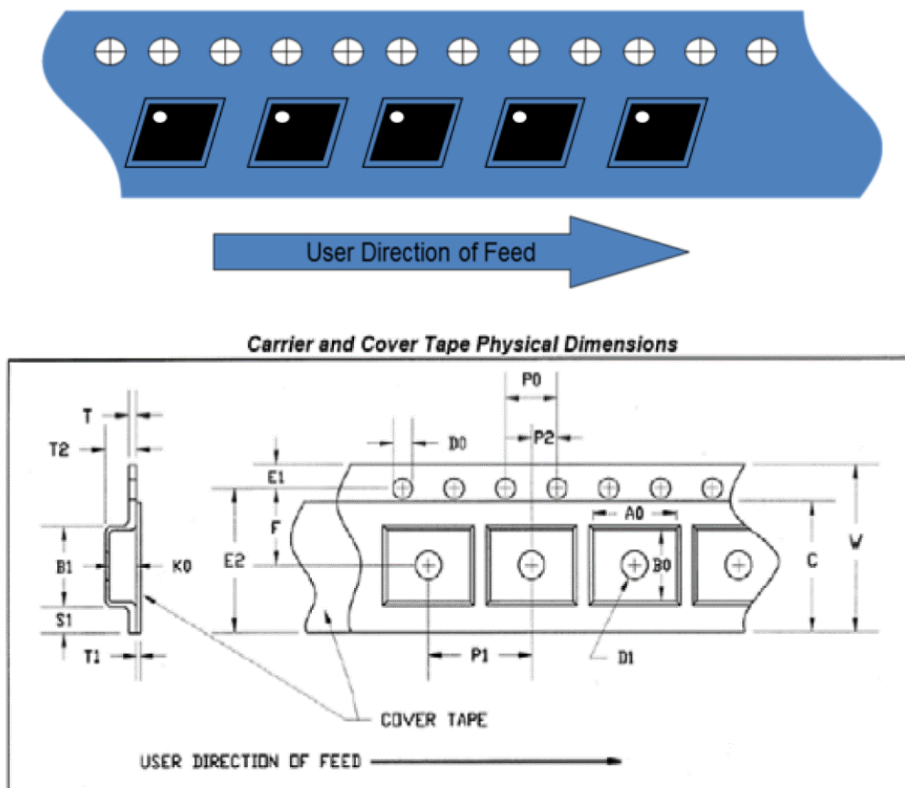
PCB Mounting Pattern

Notes:

1. All dimensions are in millimeters (inches),
2. A heatsink underneath the area of the PCB for the mounted device is recommended for proper thermal operation.
3. Ground / thermal vias are critical for the proper performance of this device.
Vias have a final plated thru diameter of .40 mm (.016").



Tape and Reel Information



CARRIER AND COVER TAPE DIMENSIONS

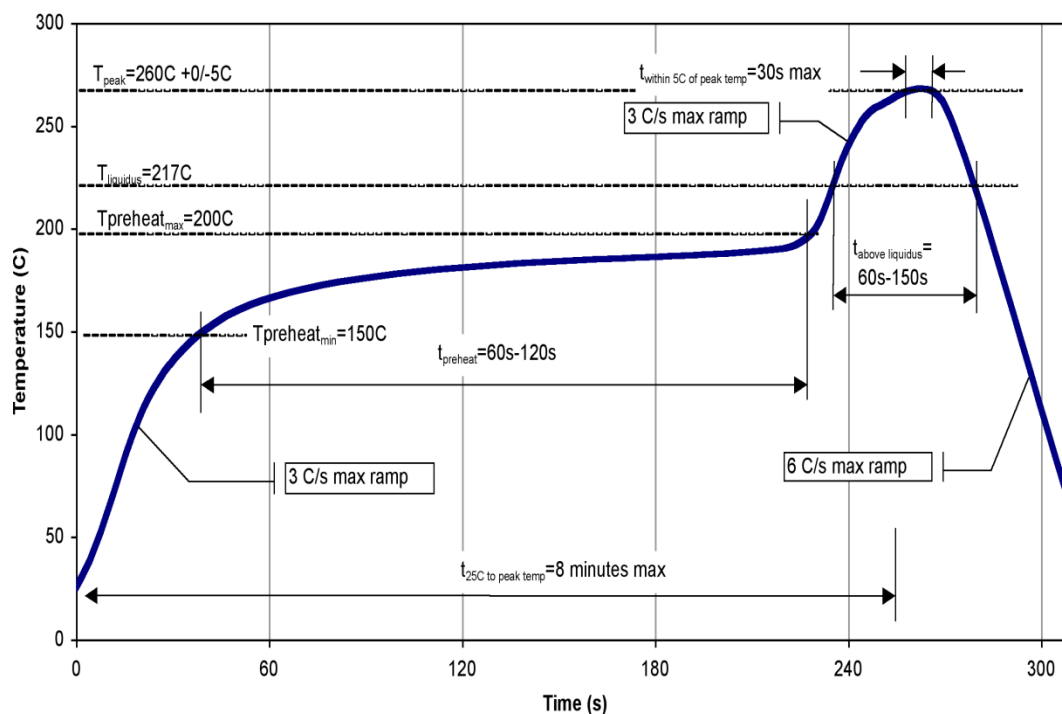
| Part | Feature | Symbol | Size (in) | Size (mm) |
|-----------------------------|--|--------|-----------|-----------|
| Cavity | Length | A0 | 0.207 | 5.25 |
| | Width | B0 | 0.207 | 5.25 |
| | Depth | K0 | 0.043 | 1.10 |
| | Pitch | P1 | 0.315 | 8.00 |
| Distance Between Centerline | Cavity to Perforation Length Direction | P2 | 0.079 | 2.00 |
| | Cavity to Perforation Width Direction | F | 0.217 | 5.50 |
| Cover Tape | Width | C | 0.374 | 9.5 |
| Carrier Tape | Width | W | 0.472 | 12.0 |

Solderability

Compatible with the latest version of J-STD-020, Lead free solder, 260°C and tin-lead (maximum 245 °C reflow temperature) soldering processes.

Contact plating: NiAu

Recommended Soldering Temperature Profile



Handling Precautions

| Parameter | Rating | Standard |
|----------------------------------|---------|---------------------------|
| ESD – Human Body Model (HBM) | Class 0 | ESDA / JEDEC JESDC22-A114 |
| MSL – Moisture Sensitivity Level | MSL3 | IPC/JEDEC J-STD-020 |



Caution!
ESD-Sensitive Device

RoHS Compliance

This part is compliant with 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) as amended by Directive 2015/863/EU.

This product also has the following attributes:

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

Contact Information

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

Web: www.qorvo.com

Tel: 1-844-890-8163

Email: customer.support@qorvo.com

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