TGA4544-SM

26 – 31 GHz 1 Watt Power Amplifier

Product Overview

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

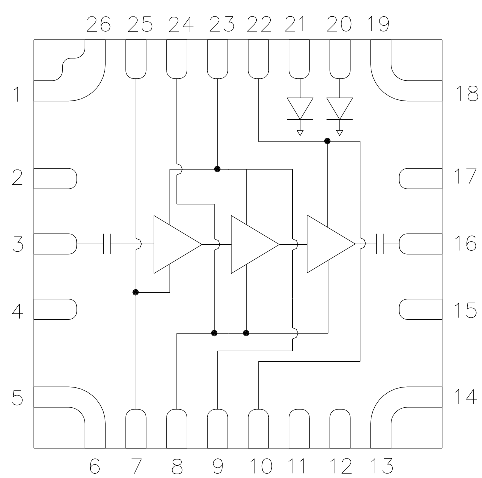
26 Lead 5 x 5 mm ACQFN package

Key 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 = -0.55 V Typical
- Package Dimensions: 5.0 x 5.0 x 1.3 mm

Performance is typical across frequency. Please reference electrical specification table and data plots for more details.

Functional Block Diagram



Applications

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

Ordering Information

Part No.	Description
TGA4544-SM	26 – 31 GHz 1W Power Amplifier
TGA4544-SM-T/R	200 pieces on a 7" reel (standard)
TGA4544-SMEVB	Evaluation Board for TGA4544-SM

Absolute Maximum Ratings

Parameter	Value / Range
Drain Voltage (V_D)	6.5 V
Gate Voltage Range (V_G)	-3.5 V to 0 V
Drain to Gate Voltage, V_D - V_G	10 V
Drain Current (I_D)	2.5 A
Gate Current (I_G)	-7 to +52 mA
Power Dissipation (P_{DISS}), T_{BASE} = 85°C	16.2 W
Input Power (P_{IN}), 50 Ω, V_D = 6 V, I_{DQ} = 1.1 A, 25 °C	25 dBm
Channel Temperature, T_{CH}	200 °C
Mounting Temperature (30 sec)	260 °C
Storage Temperature	-55 to +155 °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	Typ.	Max	Units
Drain Voltage (V_D)		+6		V
Drain Current, Quiescent (I_{DQ})		1.1		A
Drain Current, RF (I_{D_Drive})		1.7		A
Gate Voltage Typ. Range (V_G)		−0.3 to −0.75		V
Gate Current, RF (I_{G_Drive})		15		mA
Input Power at P_{SAT} (P_{IN})		-40 °C, -14 dBm +25 °C, -15 dBm +85 °C, -16 dBm		dBm
Operating Temp. Range (T_{BASE})	−40		+85	°C

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

Electrical Specifications

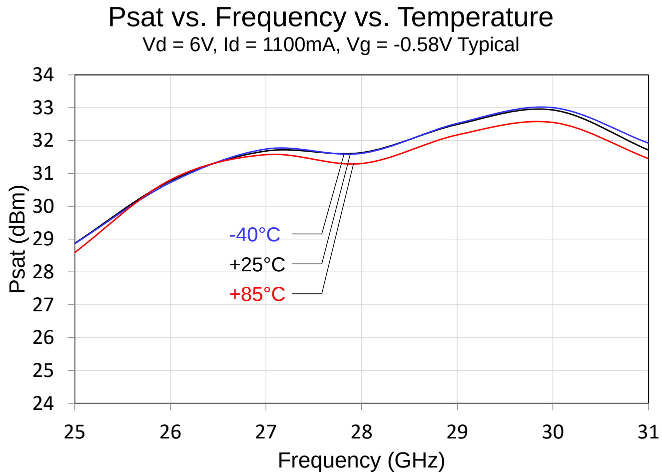
Parameter	Conditions [1] [2]	Min	Typ.	Max	Units
Operational Frequency Range		26		31	GHz
Output Power at Saturation, P_{SAT}	P_{IN} = 15 dBm		32		dBm
Output Power at 1 dB Gain Compression, P_{1dB}			31		dBm
Small Signal Gain, S21			23		dB
Input Return Loss, IRL	CW		8		dB
Output Return Loss, ORL	CW		10		dB
Output TOI	$P_{OUT/TONE}$ = 20 dBm		41		dBm
P_{SAT} Temperature Coefficient	T_{DIFF} = −40 °C to +85 °C; P_{IN} = 15 dBm		-0.01		dBm/°C
S21 Temperature Coefficient	T_{DIFF} = −40 °C to +85 °C		-0.03		dB/°C

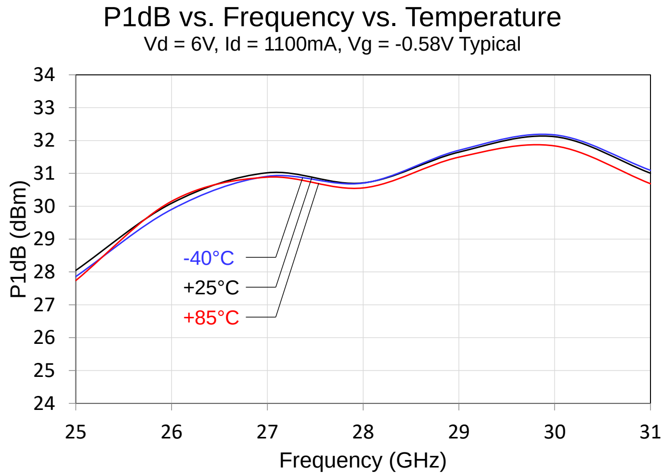
Notes:

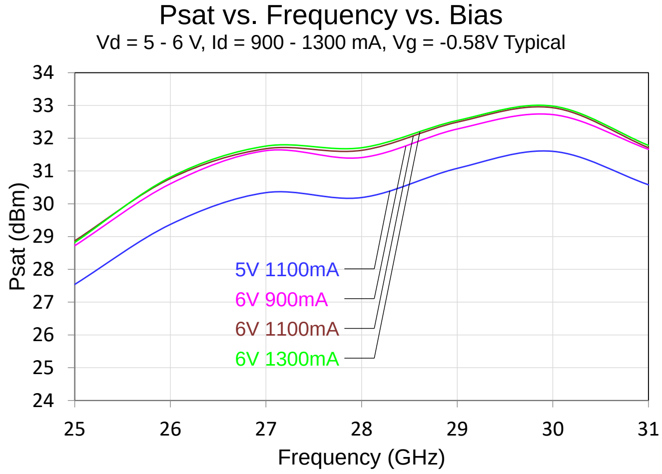
1. Test conditions unless otherwise noted: Pulsed RF, V_D = +6 V, I_{DQ} = 1.1 A, V_G = -0.55 V +/- typical, T_{BASE} = +25 °C, Z_0 = 50 Ω
2. T_{BASE} is back side of TGA4544-SM

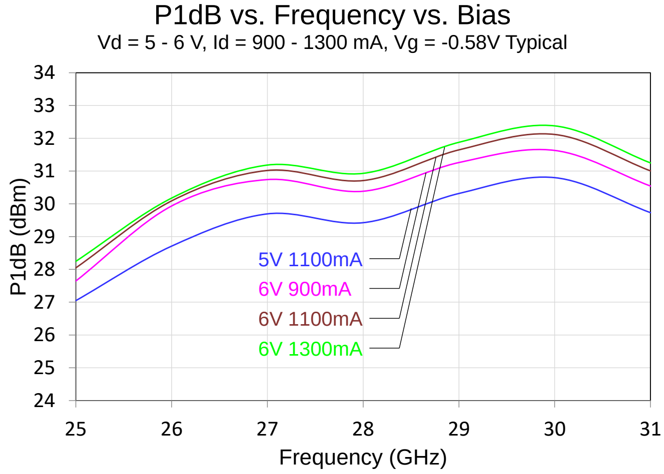
Performance Plots – Large Signal

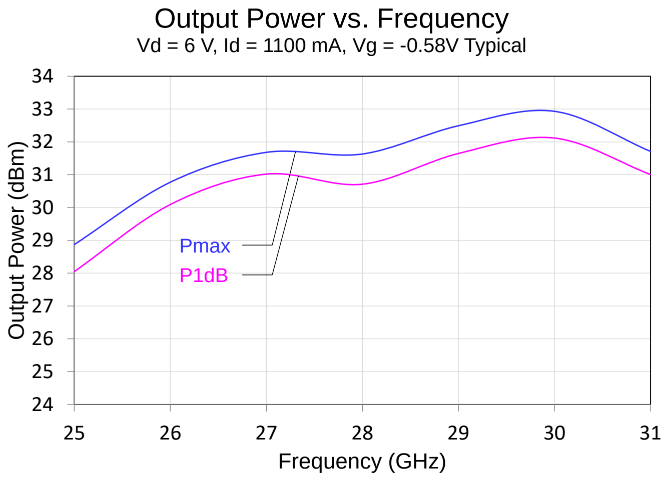
Test conditions, unless otherwise noted: V_D = 6 V, I_{DQ} = 1.1 A, P_{IN} = 15 dBm, T_{BASE} = +25 °C

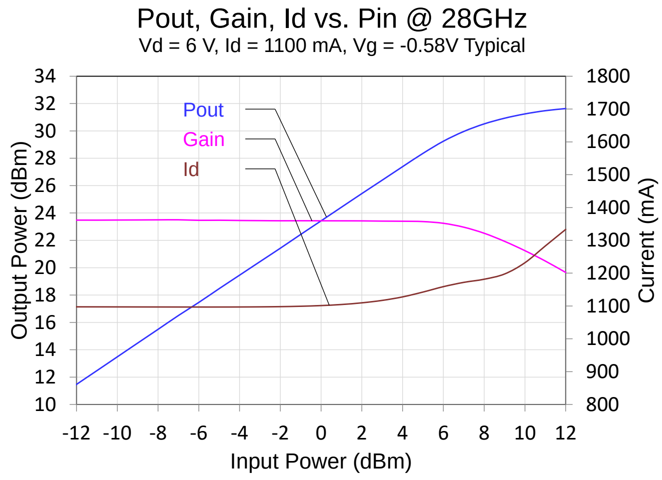






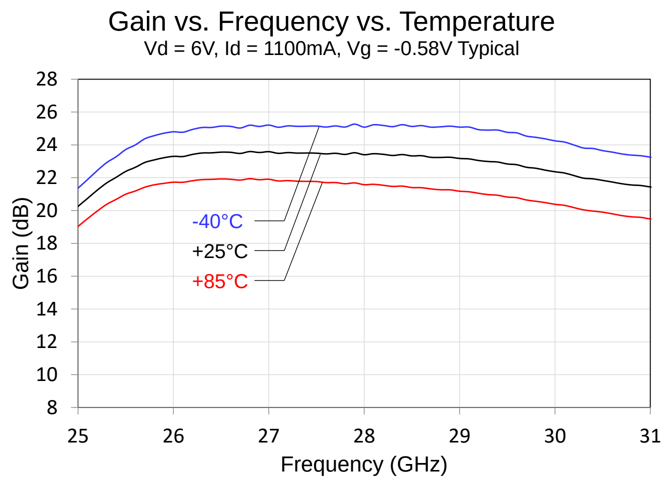


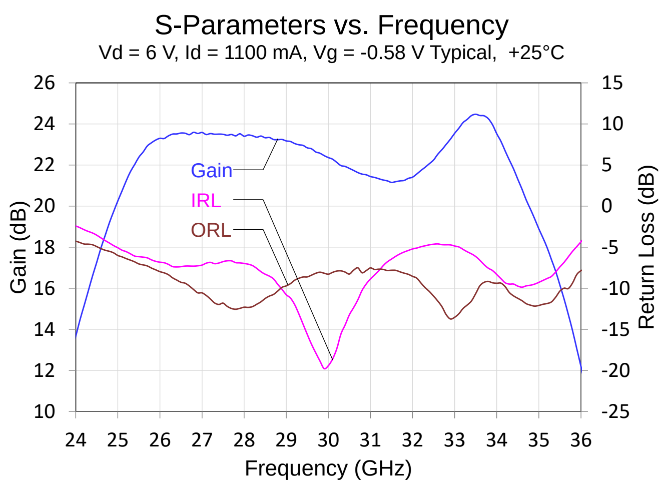


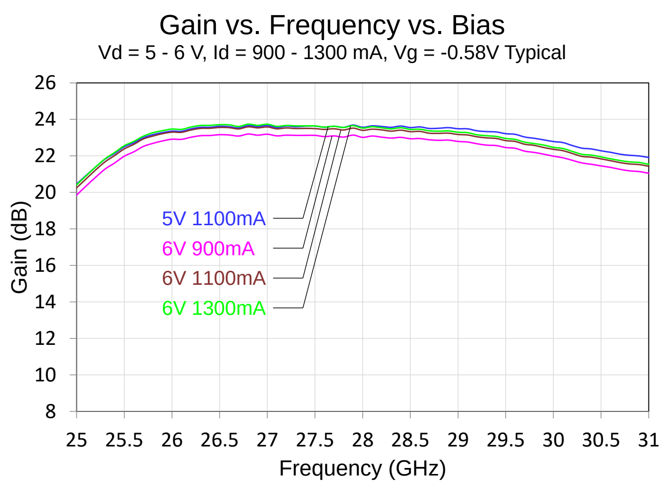


Performance Plots – Small Signal

Test conditions, unless otherwise noted: V_D = 6 V, I_{DQ} = 1.1 A, T_{BASE} = +25 °C

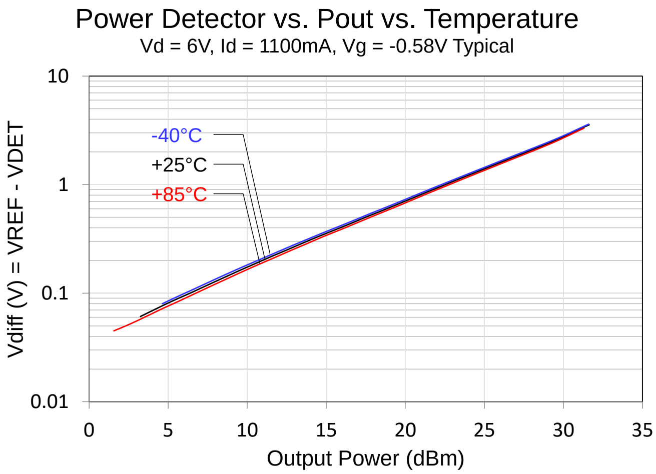


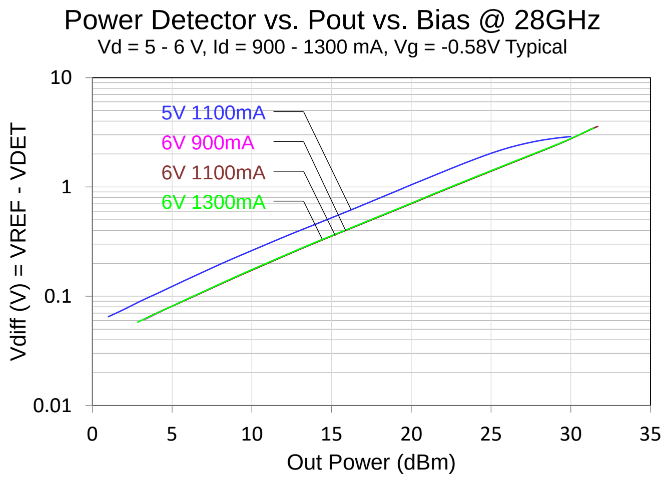


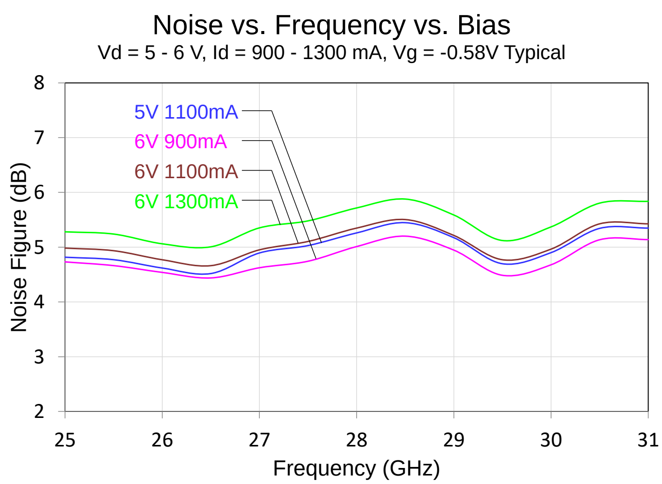


Performance Plots – Other

Test conditions, unless otherwise noted: V_D = 6 V, I_{DQ} = 1.1 A, T_{BASE} = +25 °C

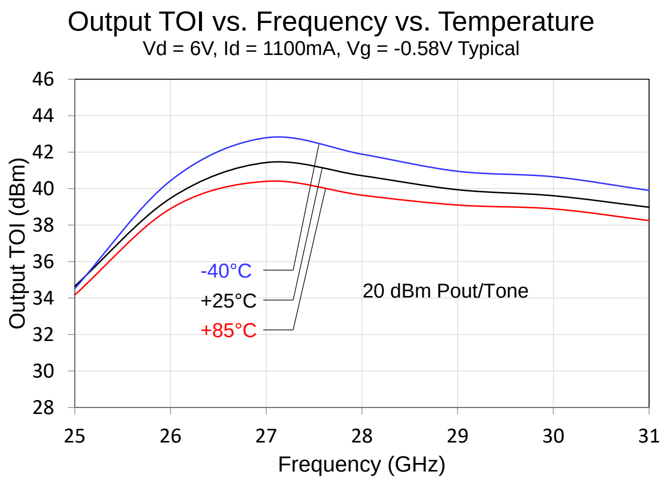


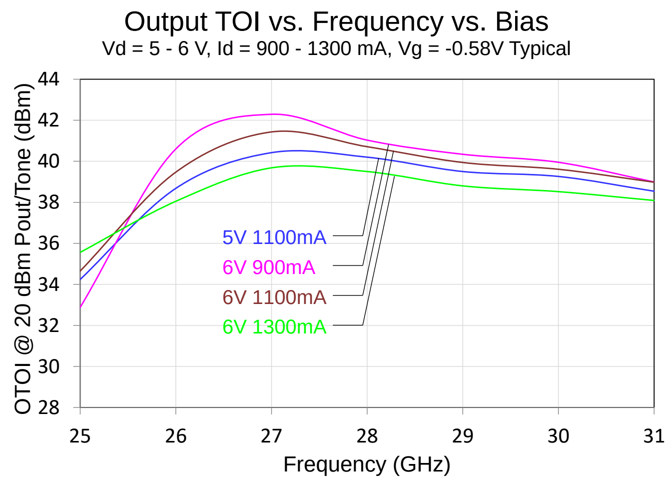


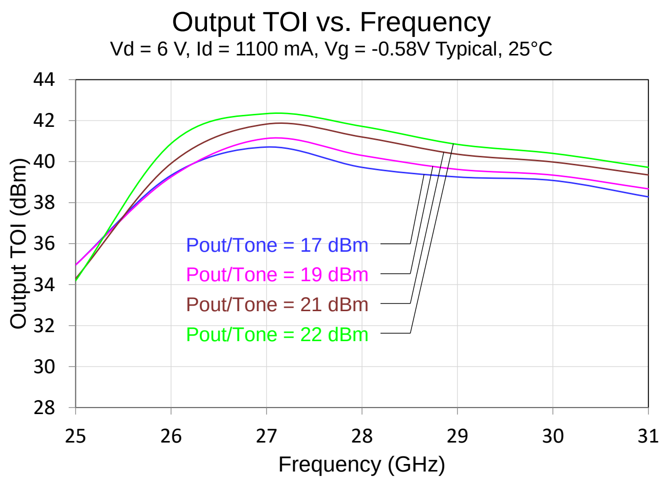


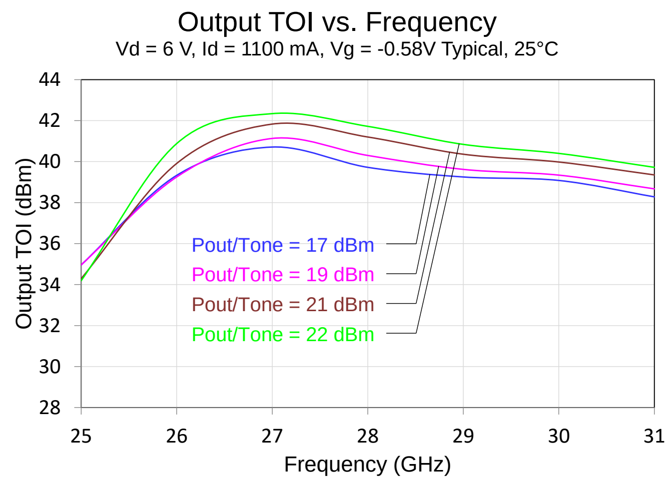
Performance Plots – Linearity

Test conditions, unless otherwise noted: V_D = 6 V, I_{DQ} = 1.1 A, T_{BASE} = +25 °C





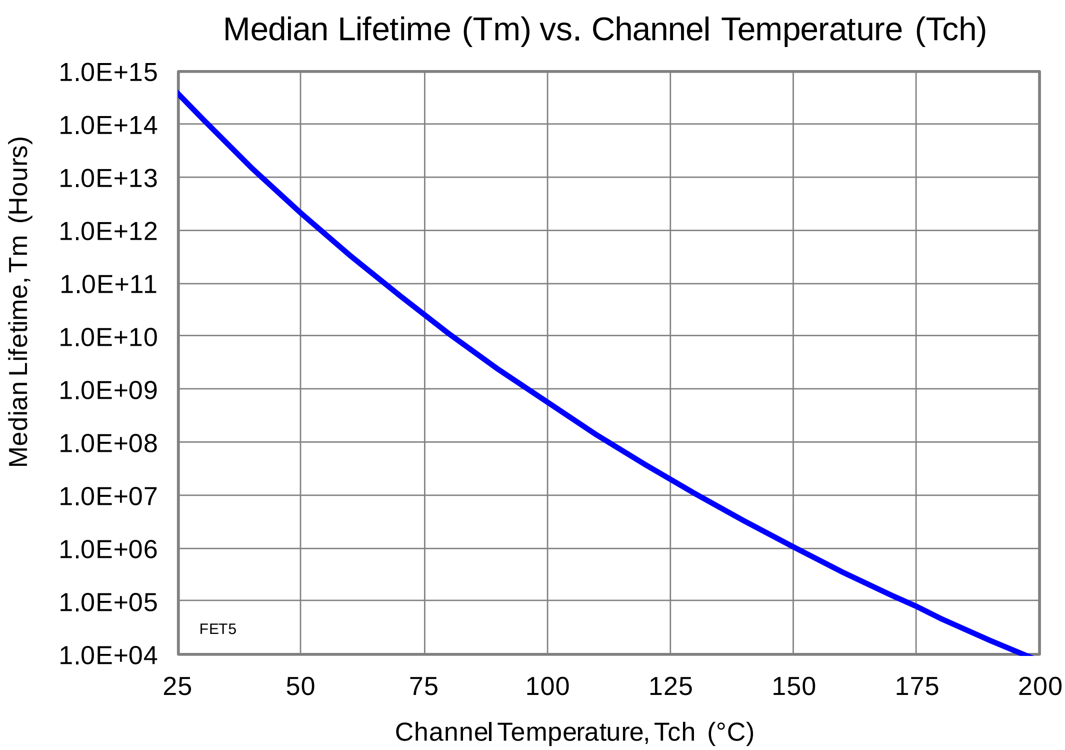




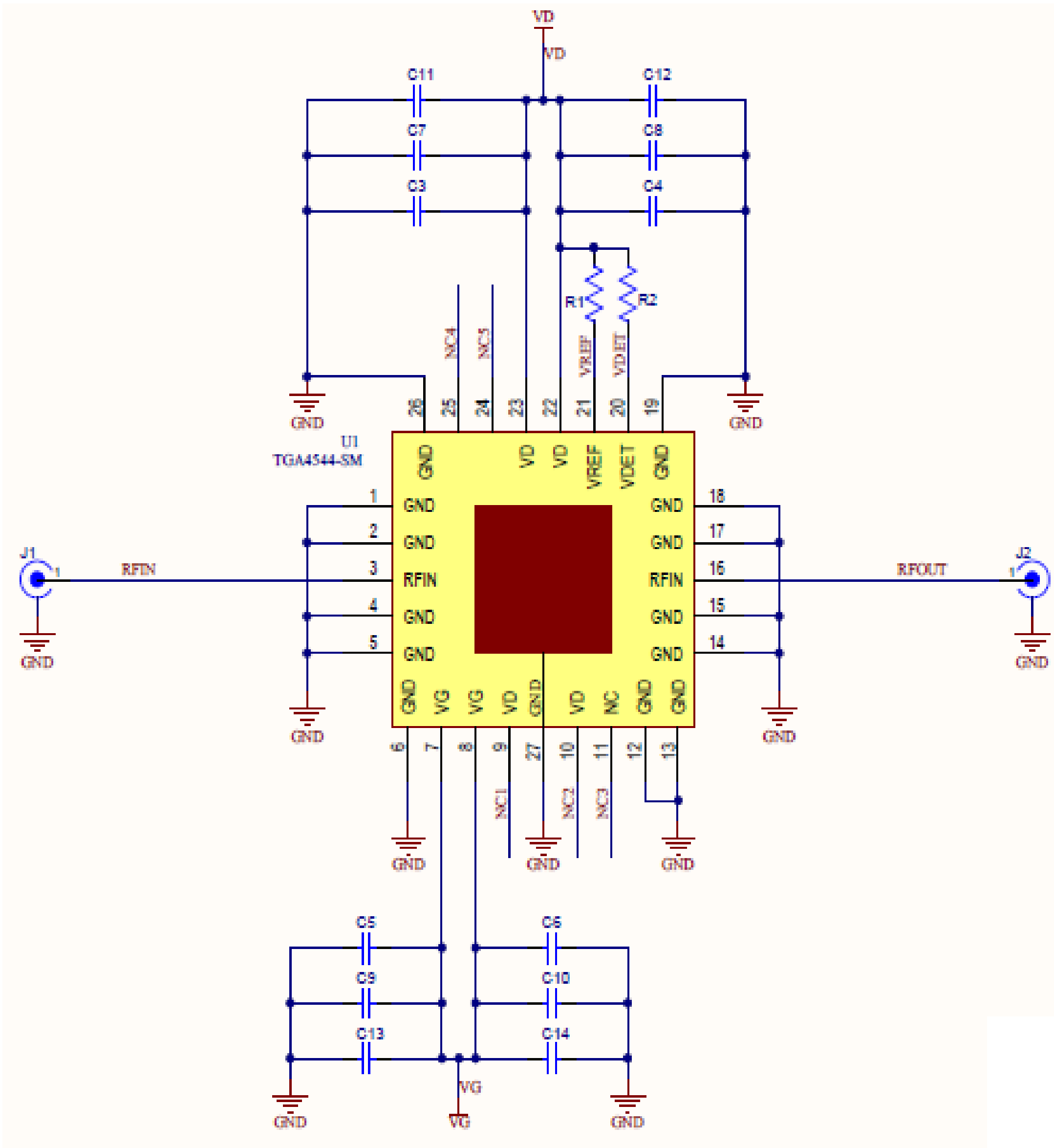
Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{base} = 85 °C, V_D = 6 V, I_{DQ} = 1.1 A, P_{DISS} = 6.6 W, No RF (quiescent DC operation)	10	ºC/W
Channel Temperature, T_{CH} (Under RF) (2)		151	°C
Thermal Resistance (θ_{JC}) (1)	T_{base} = 85 °C, V_D = 6 V, I_{DQ} = 1.1 A, Freq = 31 GHz, I_{D_Drive} = 1.65 A, P_{IN} = 16 dBm, P_{OUT} = 31.7 dBm, P_{DISS} = 8.4 W	10	ºC/W
Channel Temperature, T_{CH} (Under RF) (2)		170	°C

Notes:
1. Thermal resistance determined to the back of package, T_{BASE} (85 °C)



Applications Circuit



Vd, Vg can be biased from either side (top or bottom)

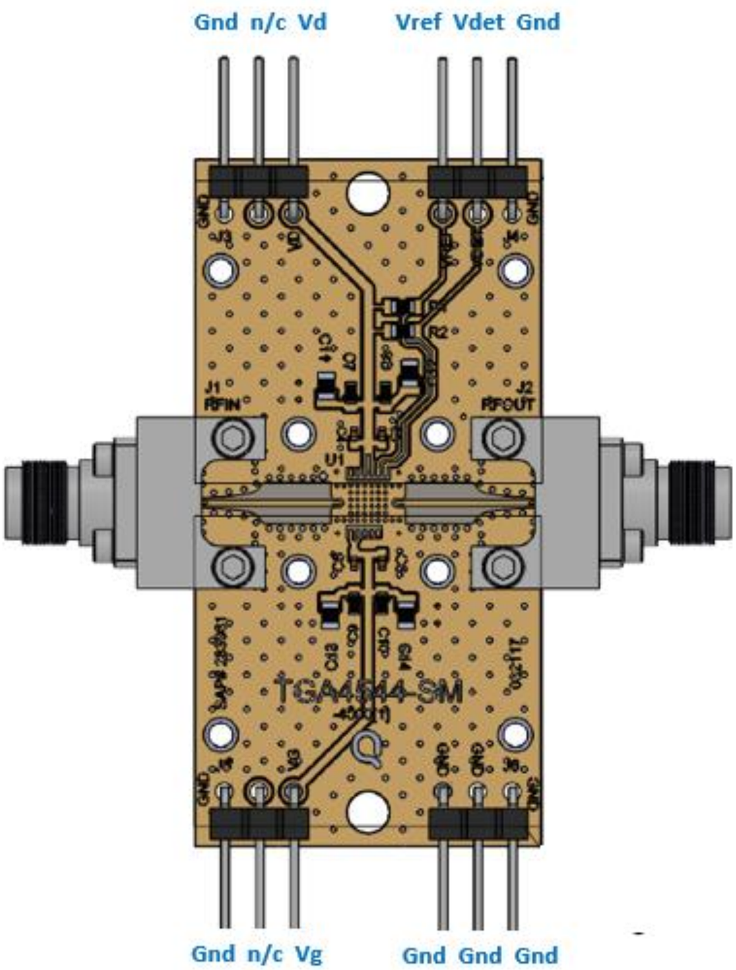
Bias-Up Procedure

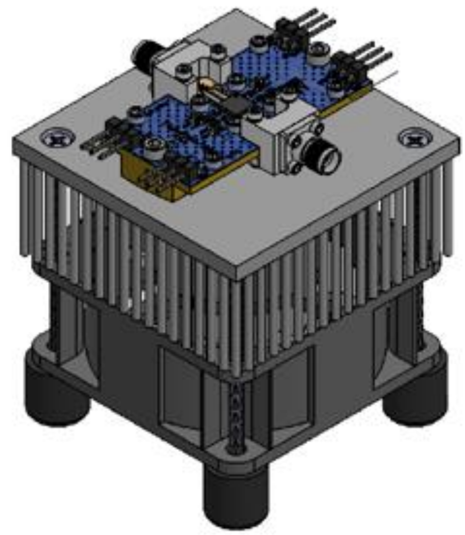
1. Set I_D limit to 2 A, I_G limit to 20 mA
2. Set V_G to −1.5 V
3. Set V_D +6 V
4. Adjust V_G more positive until I_{DQ} = 1.1 A
5. Apply RF signal

Bias-Down Procedure

1. Turn off RF signal
2. Reduce V_G to −1.5 V. Ensure I_{DQ} ~ 0 mA
4. Set V_D to 0 V
5. Turn off V_D supply
6. Turn off V_G supply

Evaluation Board (EVB) Layout



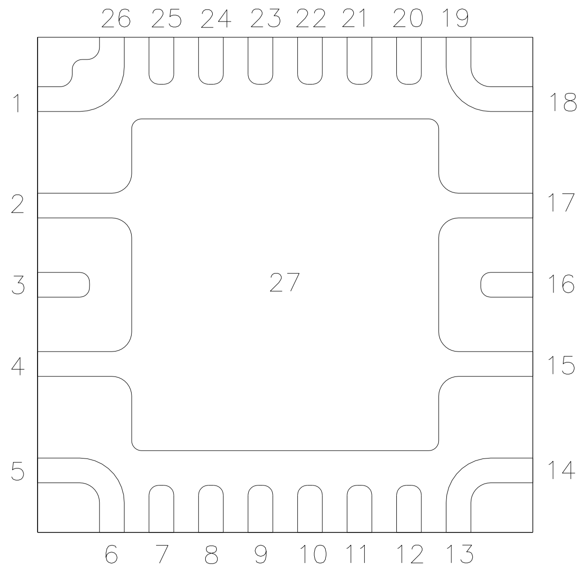


PCB board material is Rogers Corp. 4003 0.008” thickness with ½ oz copper cladding.
For further technical information, refer to the TGA4544-SM Product Information page

Bill of Materials

Reference Des.	Value	Description	Manuf.	Part Number
U1		26-31 GHz 1 W Power Amplifier	Qorvo	TGA4544-SM
C3 – C6	100 pF	CAP, 100pF, 5%, 50 V, COG, 0402	Various	
C7 – C10	1 uF	CAP, 1 uF, 10%, 50 V, X7R, 0603	Various	
C11 – C14	10 µF	CAP, 10 uF, 20%, 25 V, STD, 0803	Various	
R1, R2	47.5k Ω	RES, 47.5k, 1%, 1/10W, 0603	Various	

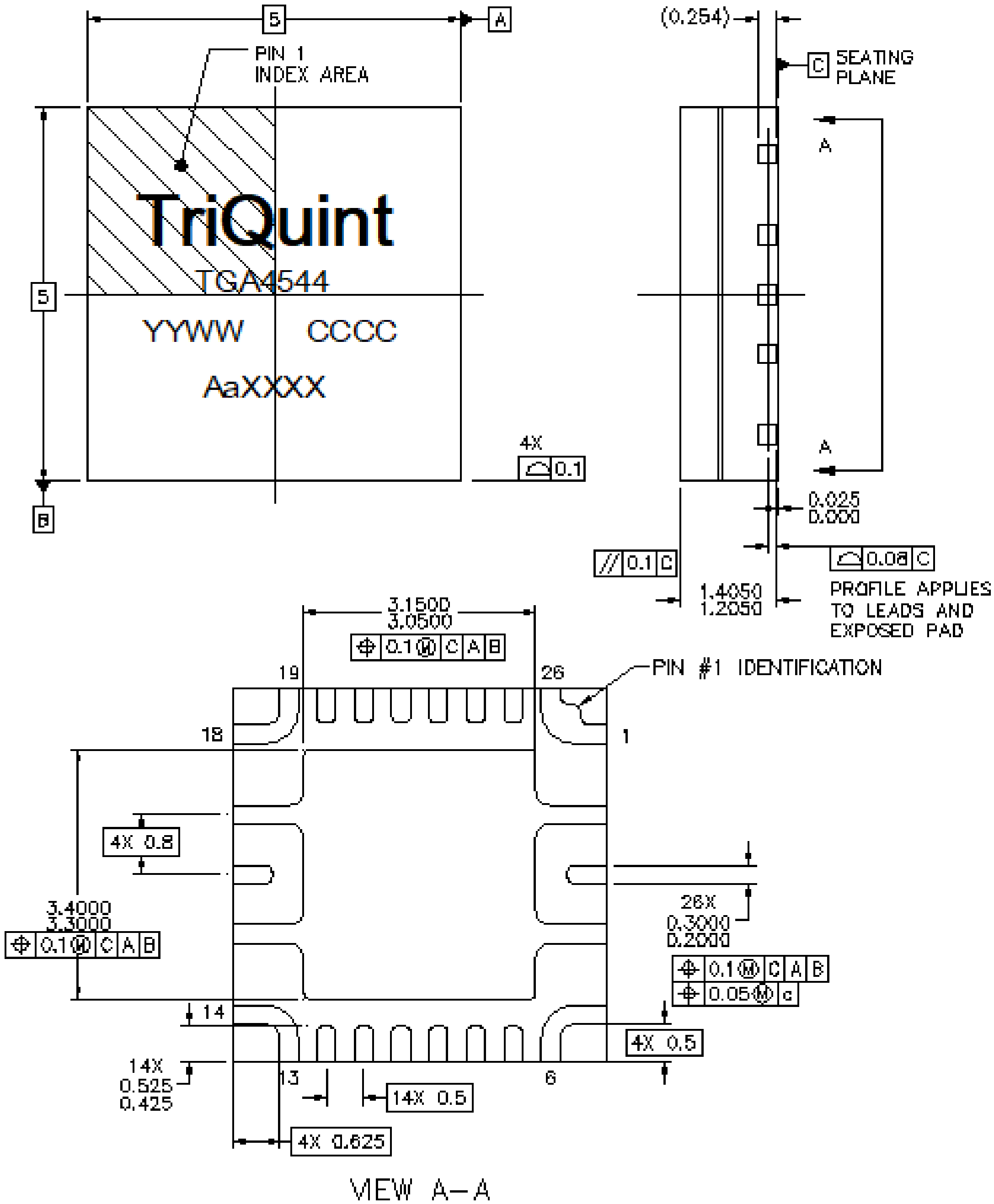
Pin Description



Pin No.	Label	Description
1, 5, 6, 13 14, 18, 19, 26	GND	Must be connected to Ground
2, 4, 15, 17	GND	Backside paddle. Multiple vias should be employed to minimize inductance and thermal resistance; see 'PCB Mounting Pattern' on page 12 for suggested footprint
3	RF IN	RF input; DC blocked, 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 (1)
10, 22	VD3	Stage 3 drain voltage (1)
11	NC	No internal connection; recommend to be grounded on the PCB
12	GND	Internally connected to GND; recommend to be grounded on the PCB
16	RF OUT	RF output; DC blocked, 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.

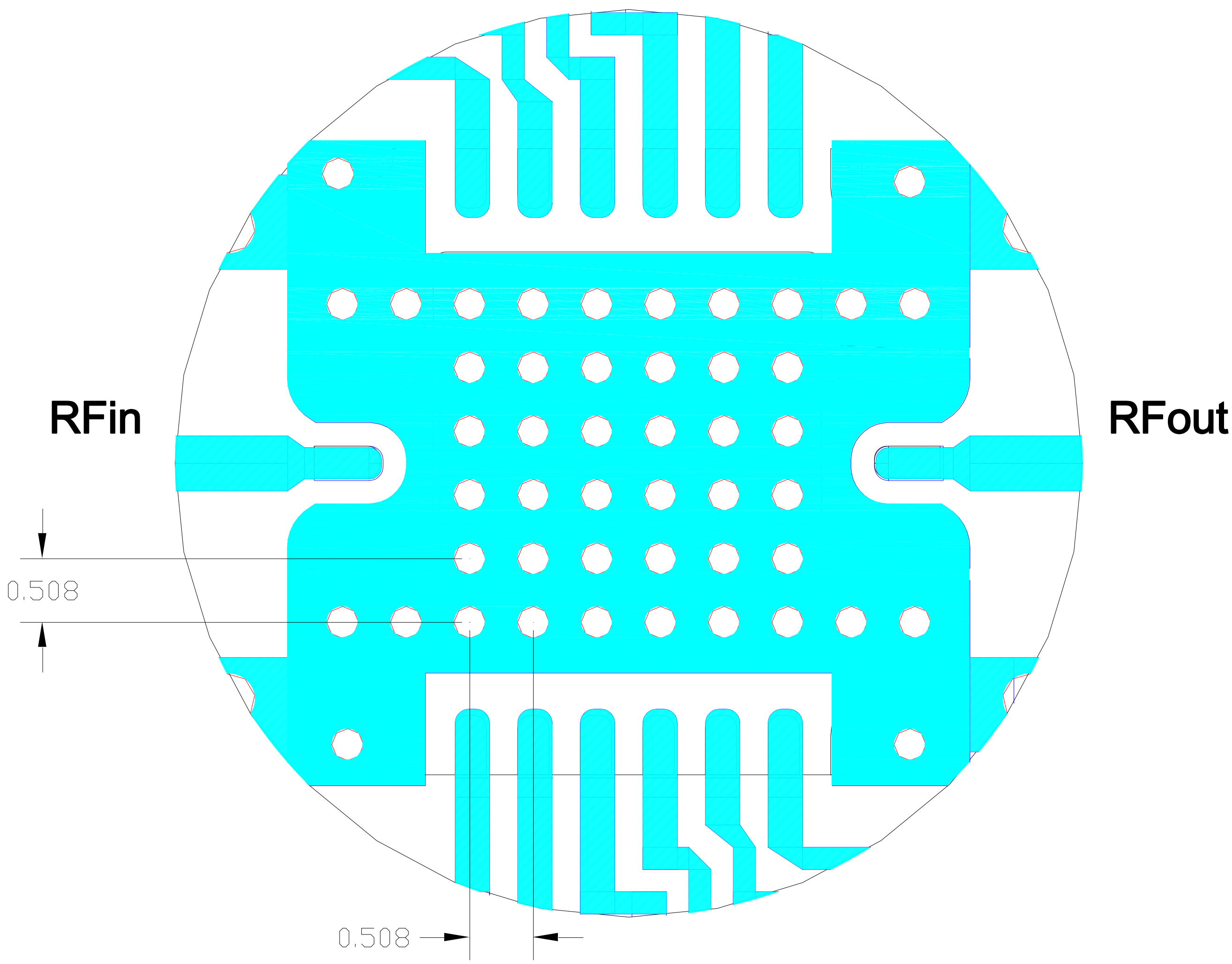
Mechanical Information



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.

PCB Mounting Pattern

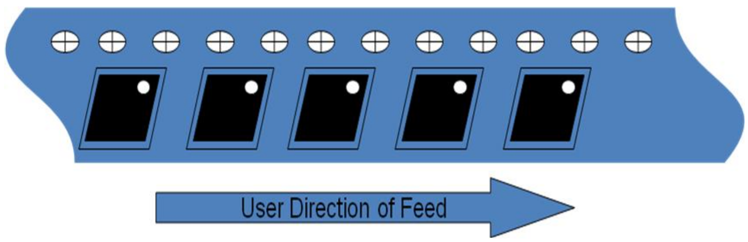


Notes:

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

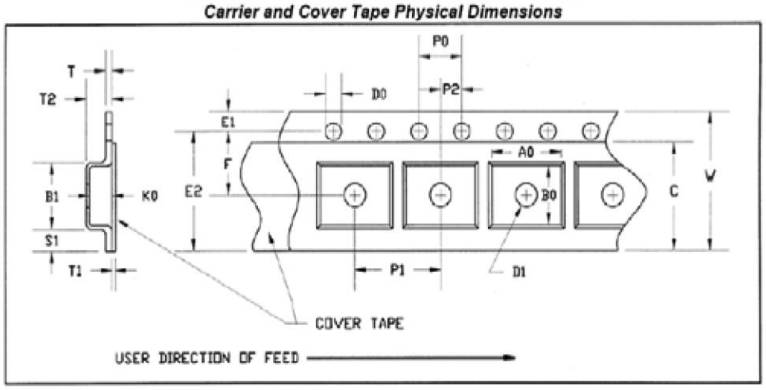
Standard T/R size = 200 pieces on a 7” reel
Vendor: Tek-Pak P/N QFN0500x0500F-L500



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



Assembly Notes

Compatible with lead-free soldering processes with 260°C peak reflow temperature.

This package is air-cavity and non-hermetic, and therefore cannot be subjected to aqueous washing. The use of no-clean solder to avoid washing after soldering is highly recommended.

Contact plating: NiPdAu

Solder rework not recommended