



TGA4539-SM

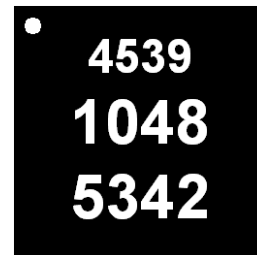
Ka Band 1W GaAs Amplifier

General Description

The Qorvo TGA4539-SM is a Ka-Band 1 Watt Power Amplifier. The TGA4539-SM operates from 28 – 30 GHz and is designed using Qorvo's 0.25 μ m GaAs power pHEMT production process.

The TGA4539-SM can provide a typical 30.5 dBm of saturated output power with small signal gain of 20 dB.

The TGA4539-SM is available in a low-cost, surface mount 20 lead 5x5 mm QFN package and is ideally suited for Point-to-Point Radio, Point-to-Multipoint and VSAT communications.



QFN 5x5 mm 20L

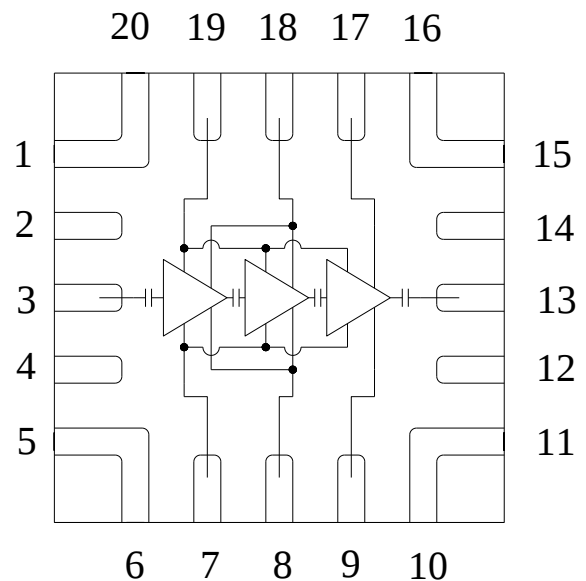
Product Features

- Frequency Range: 28 – 30 GHz
- Power: 30.5 dBm Psat, 30 dBm P1dB
- Gain: 20 dB
- Bias: $V_d = 6$ V, $I_{dq} = 420$ mA, $V_g = -0.59$ V Typical
- Package Dimensions: 5.0 x 5.0 x 1.3 mm

Applications

- Point-to-Point Radio
- Ka-Band VSAT Ground Terminal
- Point-to-Multipoint Communications

Functional Block Diagram



Ordering Information

Part No.	Description
TGA4539-SM	Ka Band GaAs Amplifier, T&R 7", Qty 500
TGA4539-SMEVB	TGA4539-SM Evaluation Board, Qty 1



Absolute Maximum Ratings

Parameter	Value	Units
Drain Voltage, Vd	+8	V
Gate Voltage, Vg	-5 to 0	V
Drain to Gate Voltage, Vd – Vg	12	V
Drain Current, Id	984	mA
Gate Current, Ig	35	mA
Power Dissipation, Pdiss	6.9	W
RF Input Power, CW, T = 25°C	22	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. Extended application of Absolute Maximum Rating conditions may reduce device reliability.

Recommended Operating Conditions

Parameter	Value	Units
Vd	6	V
Idq	420	mA
Id_drive (Under RF Drive, Constant Vg)	800	mA
Vg	-0.59	V

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

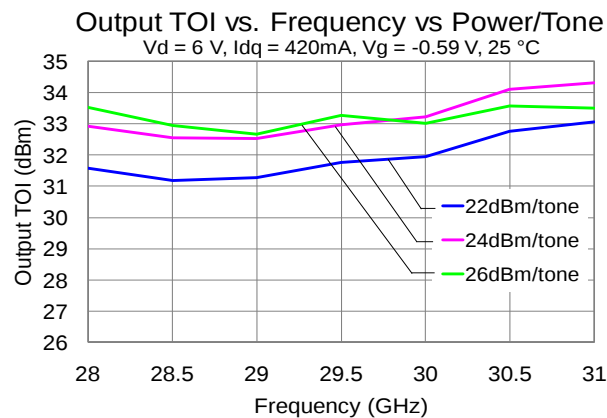
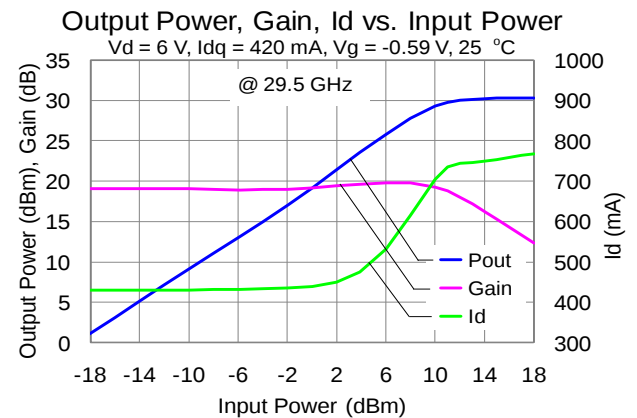
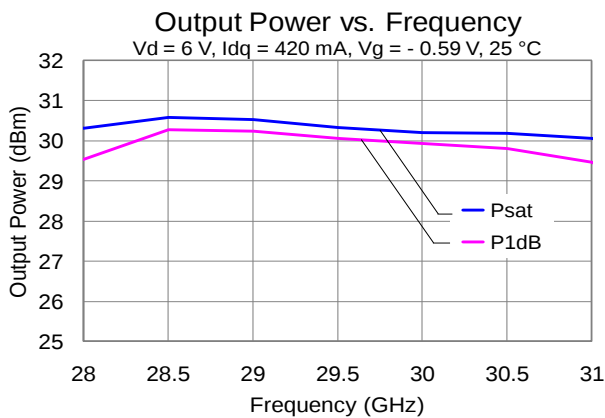
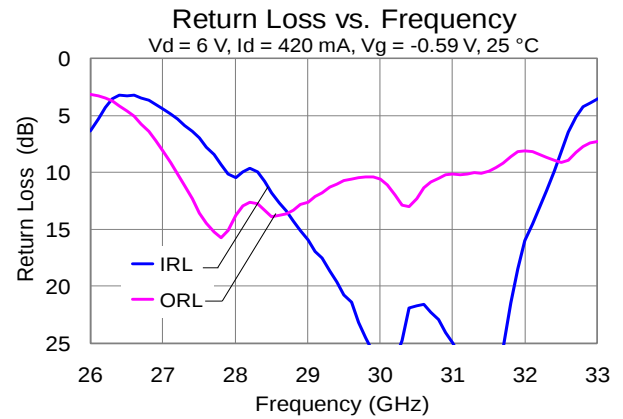
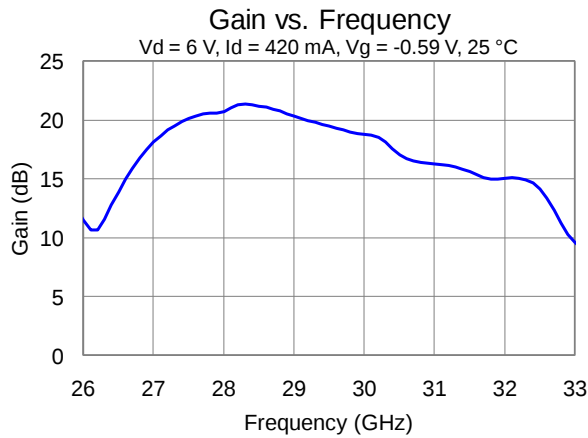
Electrical Specifications

Test conditions, unless otherwise noted: VD = 6 V, IDQ = 420 mA, 25 °C. Data de-embedded to device reference planes.

Parameter	Min	Typical	Max	Units
Operational Frequency Range	28		30	GHz
Gain	15.5	20		dB
Input Return Loss		15		dB
Output Return Loss		10		dB
Output Power @ Saturation	29.5	30.5		dBm
Output Power @ 1dB Gain Compression		30		dBm
Output TOI @ 26 dBm Pout/tone		33		dBm
Gain Temperature Coefficient		-0.06		dB/°C
Power Temperature Coefficient		-0.02		dB/°C

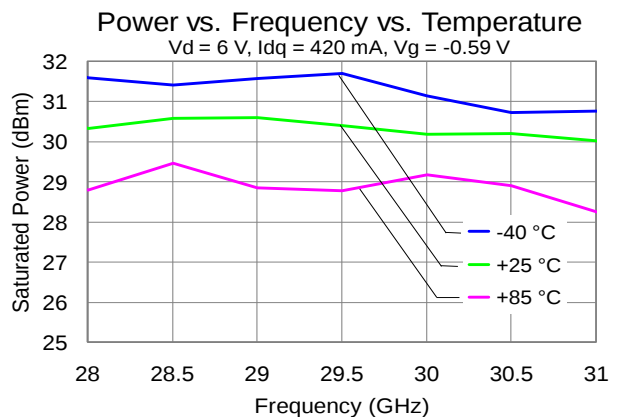
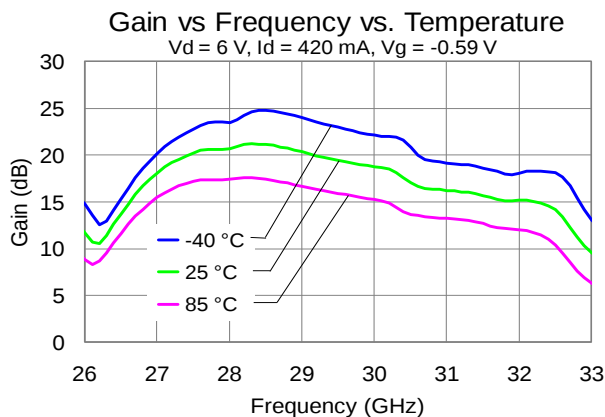
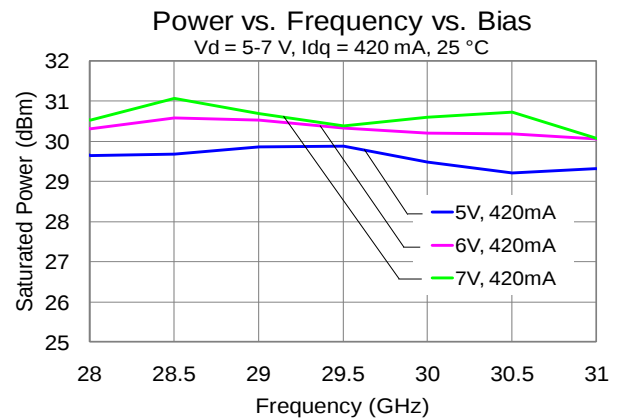
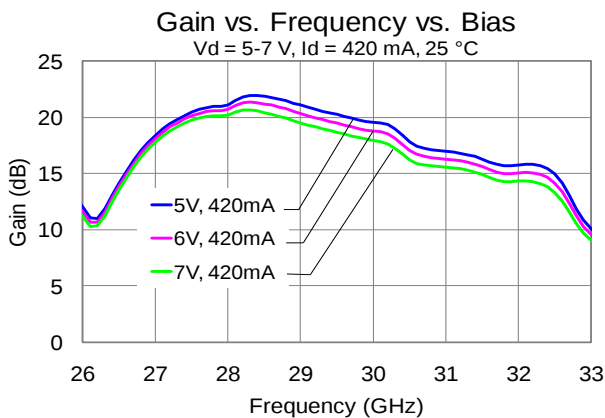
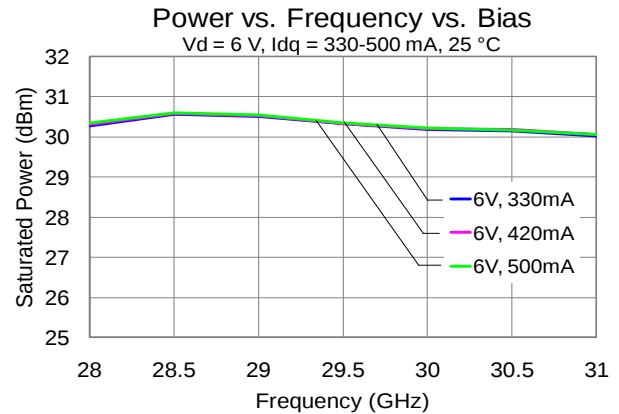
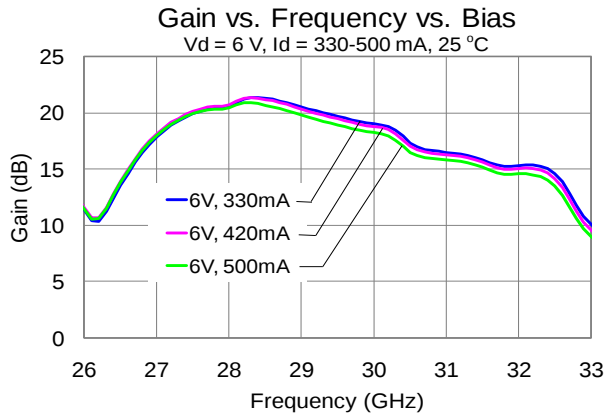
Performance Plots – Small Signal

Test Conditions unless otherwise stated: $V_D = 6.0\text{ V}$, $I_{DQ} = 420\text{ mA}$, $25\text{ }^\circ\text{C}$



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Test Conditions unless otherwise stated: $V_D = 6\text{ V}$, $I_{DQ} = 420\text{ mA}$, $25\text{ }^\circ\text{C}$

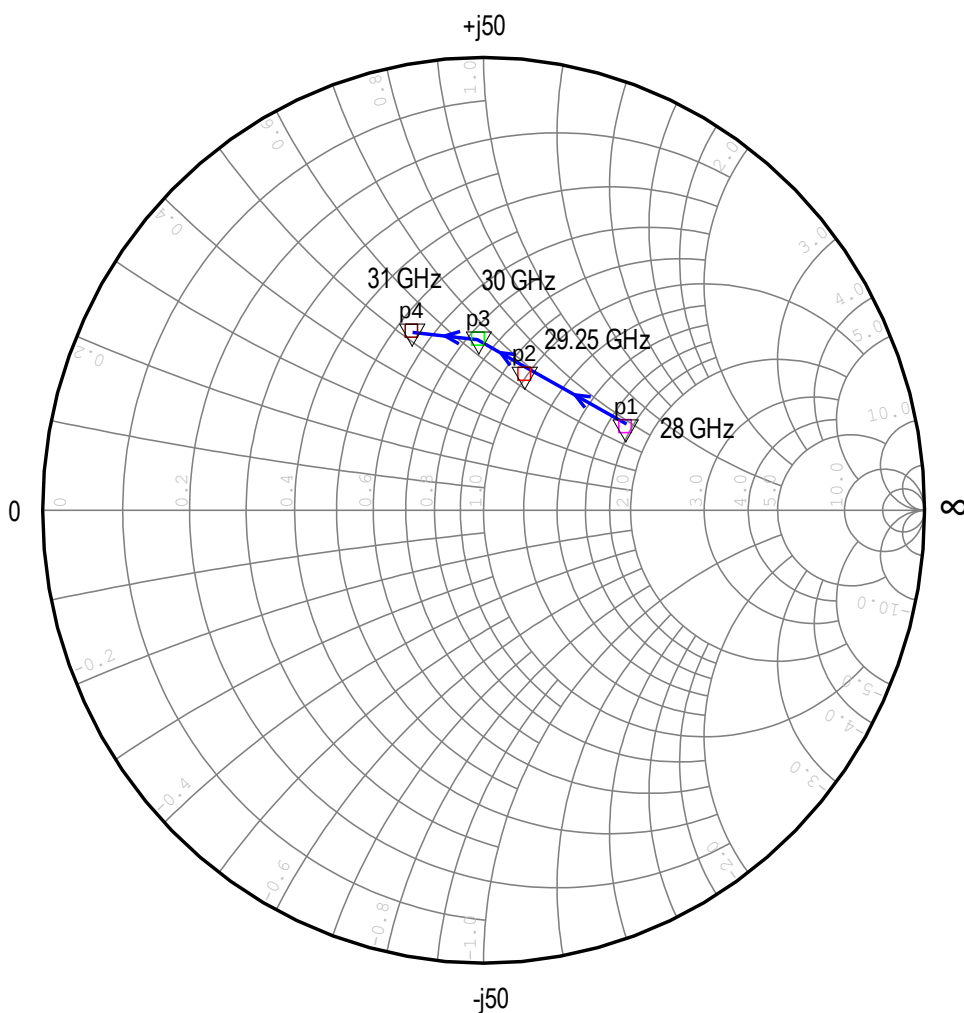


Performance Plots – Load Pull

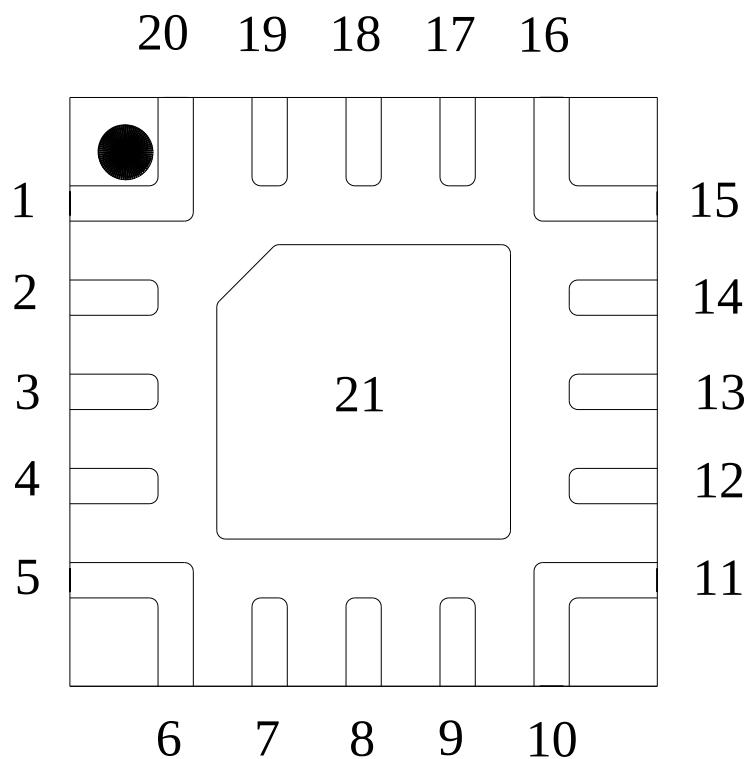
RF performance of the TGA4539-SM is optimum when placed in the impedance environment specified below. Z_{LOAD} is the load impedance presented at device output.

Test Conditions: $V_d = 6.0$ V, $I_{dq} = 420$ mA, Input power for load pull: +16 dBm. Z_{SOURCE} for load pull: $50 + j0$, 25°C.

Freq (GHz)	Γ_{LOAD}	$Z_{LOAD} (\Omega)$	Output Power (dBm)
28.0	Mag=0.371 Ang=30.1°	$86.5 + j37.5$	30.97
29.25	Mag=0.339 Ang=79.2°	$44.8 + j33.8$	30.66
30.0	Mag=0.375 Ang=91.1°	$37.2 + j32.5$	30.29
31.0	Mag=0.429 Ang=112.4°	$27.0 + j26.3$	30.06



Pad Descriptions



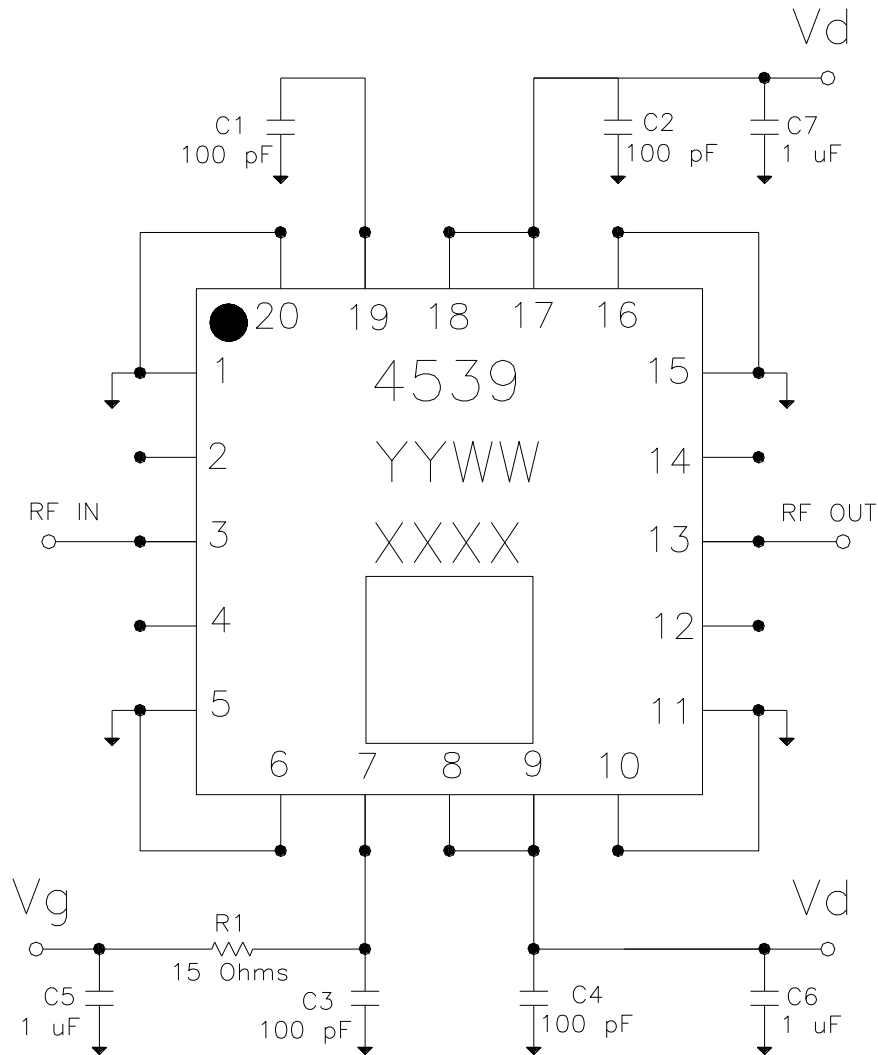
Pin Number	Label	Description
1, 5, 6, 10, 11, 15, 16, 20	N/C	Internally connected to 21; must be grounded on PCB.
2, 4, 12, 14	N/C	No internal connection; open on PCB for best performance.
3	RF IN	RF Input, DC blocked, matched to 50 ohms.
7, 19	Vg	Gate voltage.
13	RF OUT	RF Output, DC blocked, matched to 50 ohms.
8,18	Vd12_Bot, Vd12_Top	Drain voltage for 1 st and 2 nd Stage.
9,17	Vd3_Bot, Vd3_Top	Drain voltage for 3 rd Stage.
21	GND	Backside Paddle. Multiple vias should be employed on PCB to minimize inductance and thermal resistance.

[illegible]

The TGA4539-SM will be marked with the “4539” 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. The OCR-A 2D Code has four rows and is the ‘XXXX’ number, one digit per row.

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Application Circuit



Vg can be biased from either side (pin 7 or pin 19)
Vd must be biased from both side (pins 8, 9, 17, 18)

Bias-up Procedure

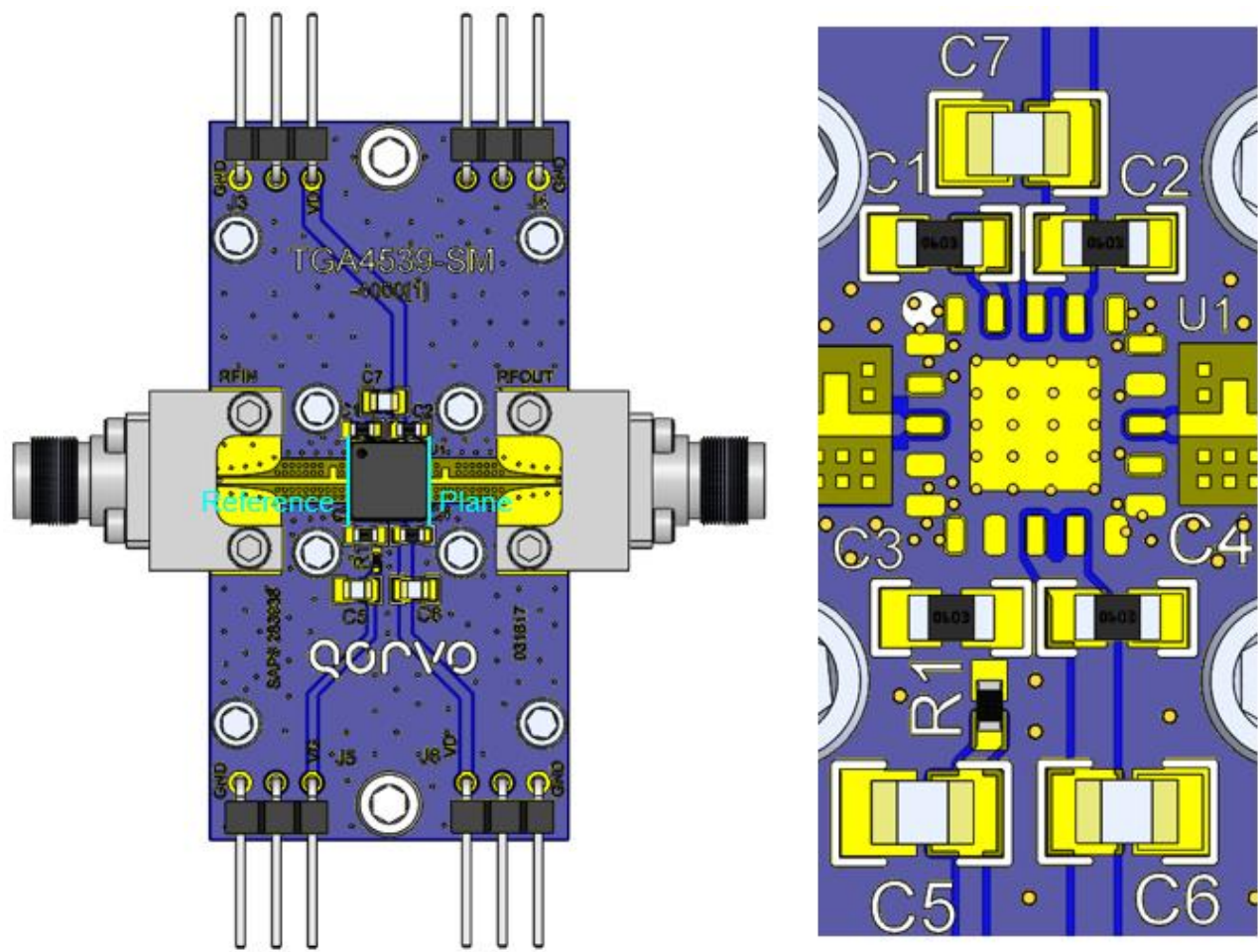
1. Set I_D limit to 1000 mA, I_G limit to 10 mA
2. Set V_G to -1.5 V
3. Set V_D to $+6.0$ V
4. Adjust V_G more positive until $I_{DQ} = 420$ mA ($V_G \sim -0.6$ V Typical)
5. Apply RF signal

Bias-down Procedure

1. Turn off RF signal
2. Reduce V_G to -1.5 V. Ensure $I_{DQ} \sim 0$ mA
3. Set V_D to 0 V
4. Turn off V_D supply
5. Turn off V_G supply



Evaluation Board and Assembly



RF Layer is 0.008" thick Rogers Corp. RO4003C ($\epsilon_r = 3.35$). Metal layers are 0.5 oz. copper. The microstrip line at the connector interface is optimized for the Southwest Microwave end launch connector 1092-01A-5.

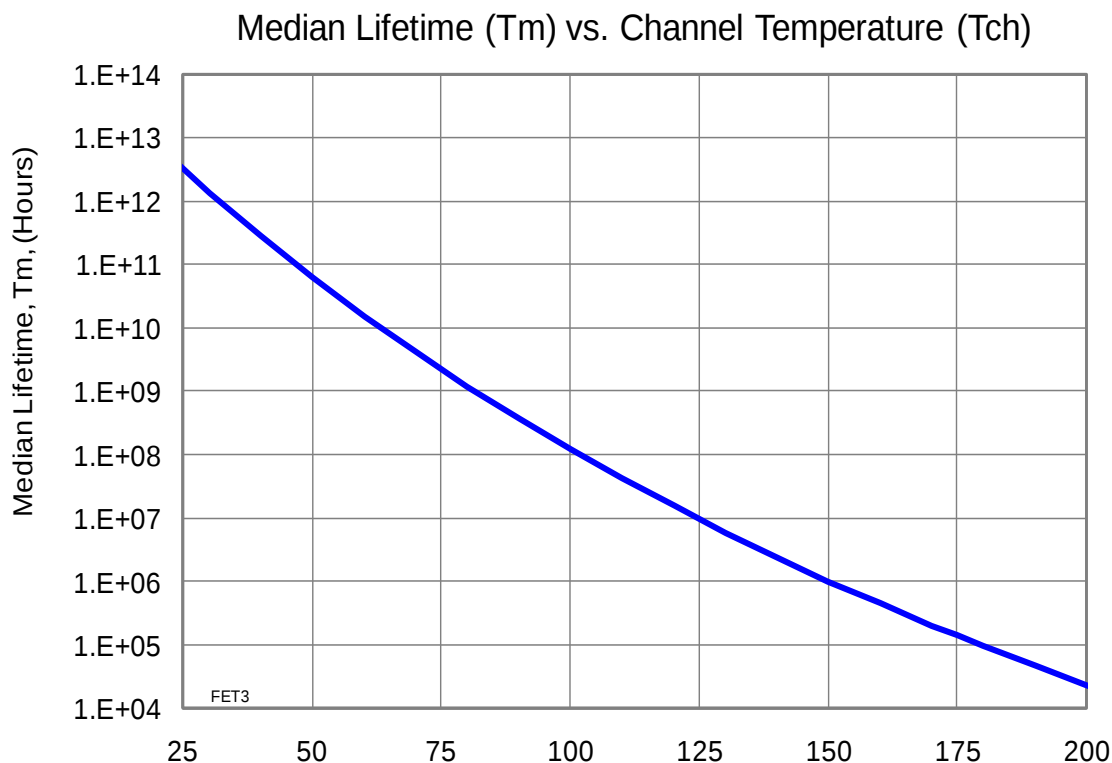
Bill of Materials

Ref. Des.	Value	Value	Manuf.	Part Number
C1 – C4	100 pF	CAP 100 pF +/-10% 16V 0402	Various	
C5 – C7	1 uF	CAP 1.0uF +/-10% 16V 0603	Various	
R1	15 Ohms	RES, 15 Ohm, 0.1 W, 0402	Various	
RF IN, RF OUT		2.92mm END LAUNCH CONNECTOR	Southwest Microwave	1092-01A-5

Thermal and Reliability Information

Parameter	Test Conditions	Value
Thermal Resistance, θ_{JC} , Measured to back of package	$T_{BASE} = 70\text{ }^{\circ}\text{C}$	$\theta_{JC} = 21.9\text{ }^{\circ}\text{C/W}$
Channel Temperature (T_{CH}), and Median Lifetime (T_M), Quiescent or small signal	$T_{BASE} = 70\text{ }^{\circ}\text{C}$, $V_D = 6\text{ V}$, $I_{DQ} = 420\text{ mA}$ $P_{DISS} = 2.52\text{ W}$	$T_{CH} = 125\text{ }^{\circ}\text{C}$ $T_M = 1.0\text{ E}+7\text{ Hours}$
Channel Temperature (T_{CH}), and Median Lifetime (T_M) Under RF Drive, Under RF drive	$T_{BASE} = 70\text{ }^{\circ}\text{C}$, $V_D = 6\text{ V}$, $I_D = 800\text{ mA}$ $P_{OUT} = 30.5\text{ dBm}$, $P_{DISS} = 3.8\text{ W}$	$T_{CH} = 153\text{ }^{\circ}\text{C}$ $T_M = 9.6\text{ E}+5\text{ Hours}$

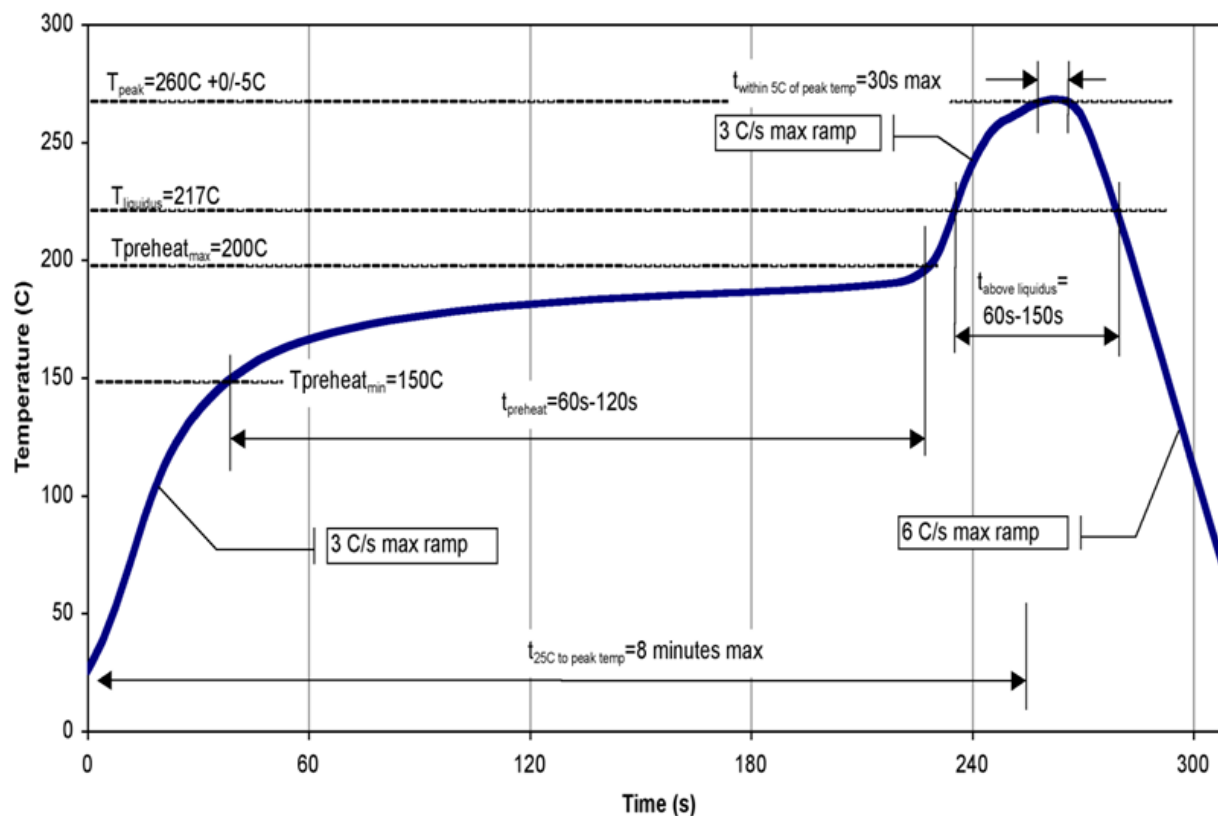
Median Lifetime



Solderability

1. Compatible with the latest version of J-STD-020, Lead-free solder, 260 °C.
2. The use of no-clean solder to avoid washing after soldering is recommended.

Recommended Soldering Temperature Profile

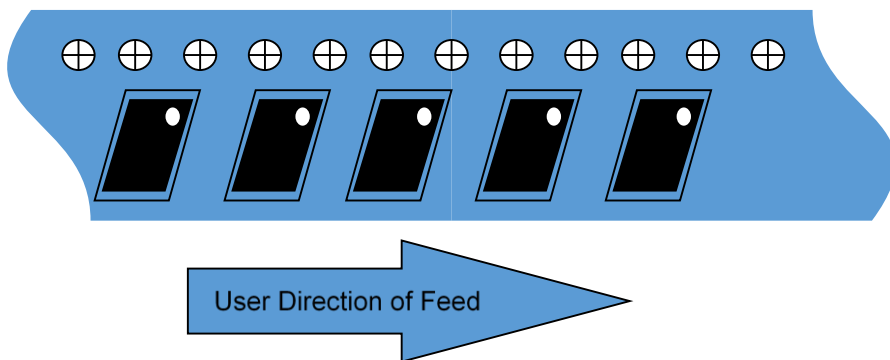
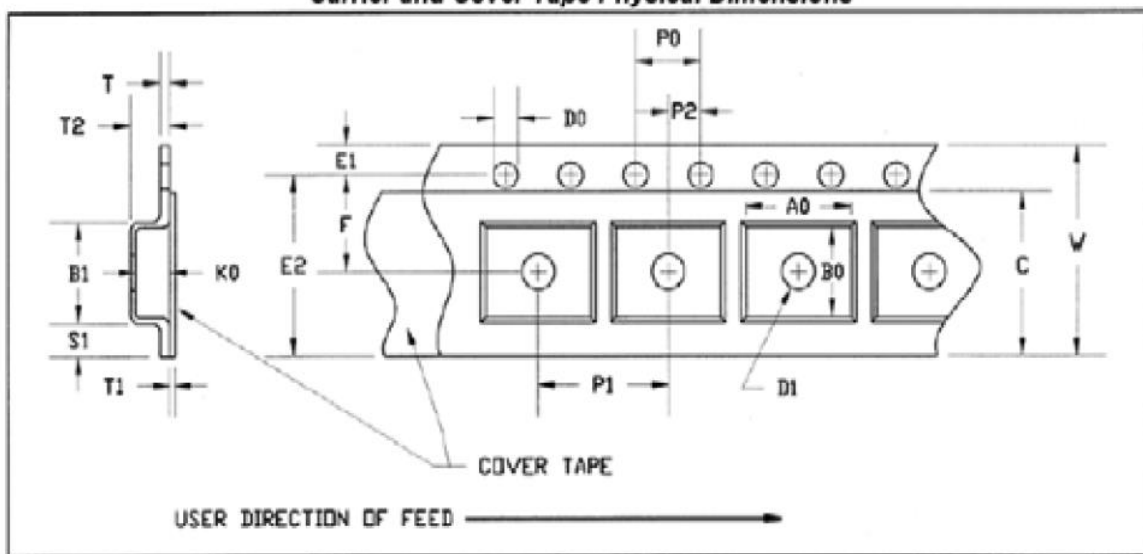


Tape and Reel Information

Standard T/R size = 500 pieces on a 7 x 0.5 " reel.

Material		Cavity (mm)				Distance Between Centerline (mm)		Carrier Tape (mm)	Cover Carrier (mm)
Vendor	Vendor P/N	Length (A0)	Width (B0)	Depth (K0)	Pitch (P1)	Length direction (P2)	Width Direction (F)	Width (W)	Width (C)
Tek-Pak	QFN0400X0 400D	5.25	5.25	1.80	8.00	2.00	5.50	12.00	9.50

Carrier and Cover Tape Physical Dimensions



Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	1A	ESDA / JEDEC JS-001-2012
ESD – Charged Device Model (CDM)	N / A	ESDA / JEDEC JS-002-2014
MSL – Convection Reflow 260 °C	1	JEDEC standard IPC/JEDEC J-STD-020



Caution!
ESD-Sensitive Device

RoHS Compliance

This product is compliant with the 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.

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Email: customer.support@qorvo.com

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