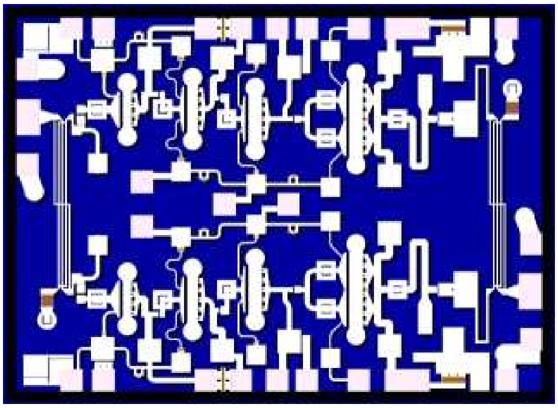
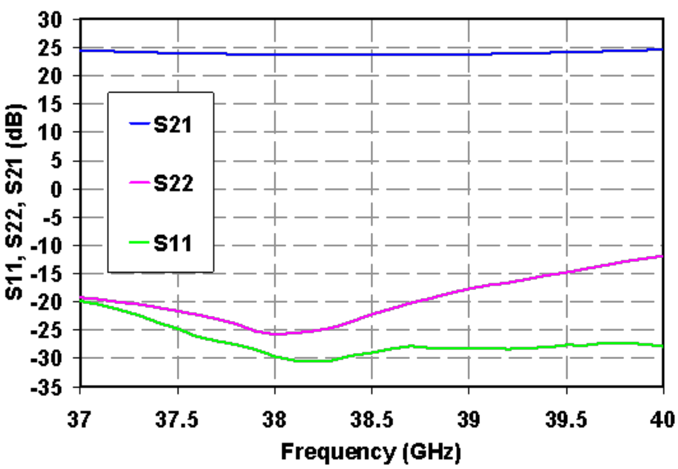
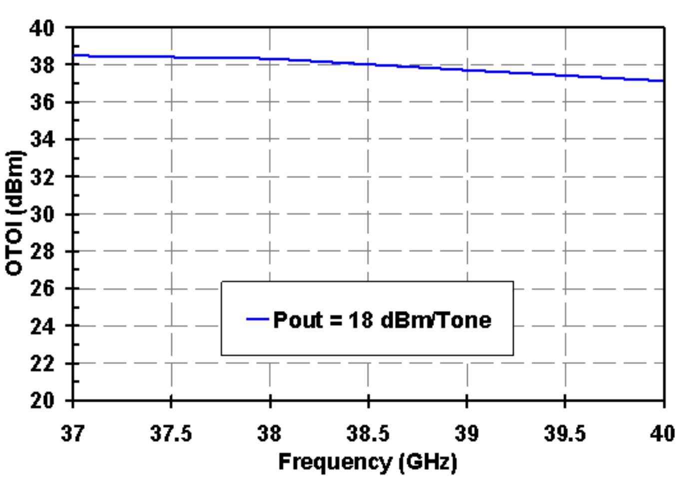
37 - 40 GHz Power Amplifier



Measured Performance

Bias conditions: Vd = 5 V, Idq = 600 mA, Vg = -0.63 V Typical





Key Features

- Frequency Range: 37 - 40 GHz
- OTOI: 37 dBm
- Small Signal Gain: 24 dB
- 29.5 dBm Psat, 28 dBm P1dB @ 5V, 600mA
- 30.5 dBm Psat, 29.5 dBm P1dB @ 6V, 600mA
- Chip Dimensions: 2.30 x 1.66 x 0.10 mm

Primary Applications

- Point-to-Point Radio
- mmW Communications

Product Description

The TriQuint TGA4538 operates from 37-40 GHz and is designed using TriQuint's 3MI Power pHEMT production process.

The TGA4538 provides a nominal 29.5 dBm of saturated power with a small signal gain of 24 dB at Vd = 5V and Idq = 600mA. When biased at 6V, 600mA, TGA4538 provides a nominal 30.5 dBm of saturated power with a small signal gain of 24dB.

The TGA4538 is suitable for a variety of systems such as Point-to-Point radio and Millimeter-Wave Communications.

The TGA4538 is 100% DC and RF tested on-wafer to ensure performance compliance. The TGA4538 has a protective surface passivation layer providing environmental robustness.

Lead-Free & RoHS compliant.
Evaluation Boards are available upon request.

Table I
Absolute Maximum Ratings 1/

Symbol	Parameter	Value	Notes
Vd-Vg	Drain to Gate Voltage	10 V	
Vd	Drain Voltage	6.5 V	2/
Vg	Gate Voltage Range	-5 to 0 V	
Id	Drain Current	1390 mA	2/
Ig	Gate Current Range	-4.2 to 92 mA	
Pin	Input Continuous Wave Power	22 dBm	2/
Tchannel	Channel Temperature	200 °C	

1/ These ratings represent the maximum operable values for this device. Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device and / or affect device lifetime. These are stress ratings only, and functional operation of the device at these conditions is not implied.

2/ Combinations of supply voltage, supply current, input power, and output power shall not exceed the maximum power dissipation listed in Table IV.

Table II
Recommended Operating Conditions

Symbol	Parameter 1/	Value
Vd	Drain Voltage	5 V
Idq	Drain Current	600 mA
Id_Drive	Drain Current under RF Drive	1000 mA
Vg	Typical Gate Voltage	-0.63 V

1/ See assembly diagram for bias instructions.

Table III
RF Characterization Table

Bias: Vd = 5 V, Idq = 600 mA, Vg = -0.63 V Typical

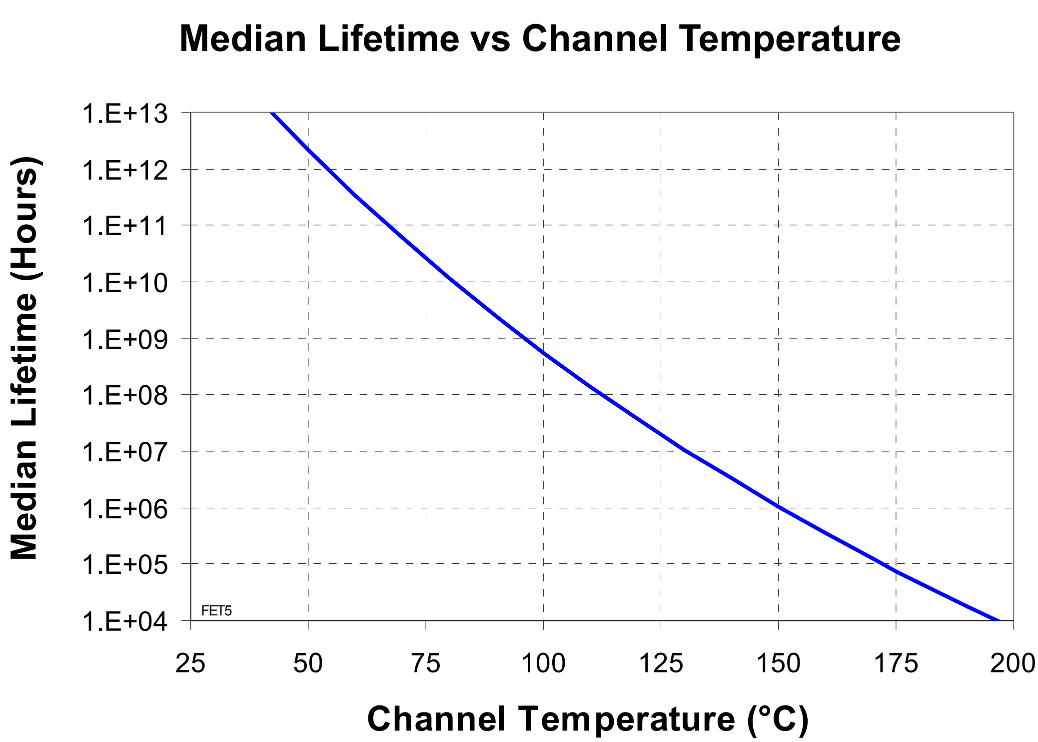
SYMBOL	PARAMETER	TEST CONDITIONS	MIN	NOMINAL	MAX	UNITS
Gain	Small Signal Gain	f = 37 - 40 GHz	23	25		dB
IRL	Input Return Loss	f = 37 - 40 GHz		20		dB
ORL	Output Return Loss	f = 37 - 40 GHz		15		dB
Psat	Saturated Output Power	f = 37 - 40 GHz		29.5		dBm
P1dB	Output Power @ 1dB compression	f = 37 - 40 GHz	27	28		dBm
OTOI	Output TOI	f = 37 - 40 GHz	33	37		dBm

Bias: Vd = 6 V, Idq = 600 mA, Vg = -0.67 V Typical

SYMBOL	PARAMETER	TEST CONDITIONS	NOMINAL	UNITS
Gain	Small Signal Gain	f = 37 - 40 GHz	24	dB
IRL	Input Return Loss	f = 37 - 40 GHz	19	dB
ORL	Output Return Loss	f = 37 - 40 GHz	15	dB
Psat	Saturated Output Power	f = 37 - 40 GHz	30.5	dBm
P1dB	Output Power @ 1dB compression	f = 37 - 40 GHz	29.5	dBm
OTOI	Output TOI	f = 37 - 40 GHz	37	dBm

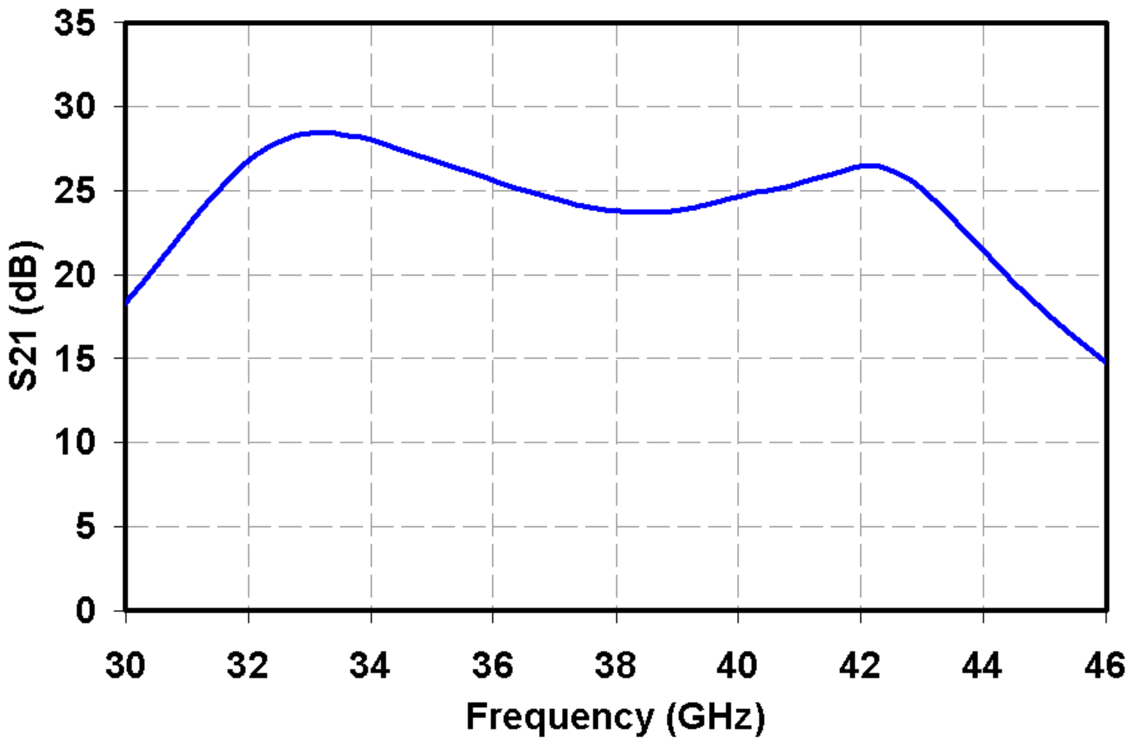
Table IV
Power Dissipation and Thermal Properties

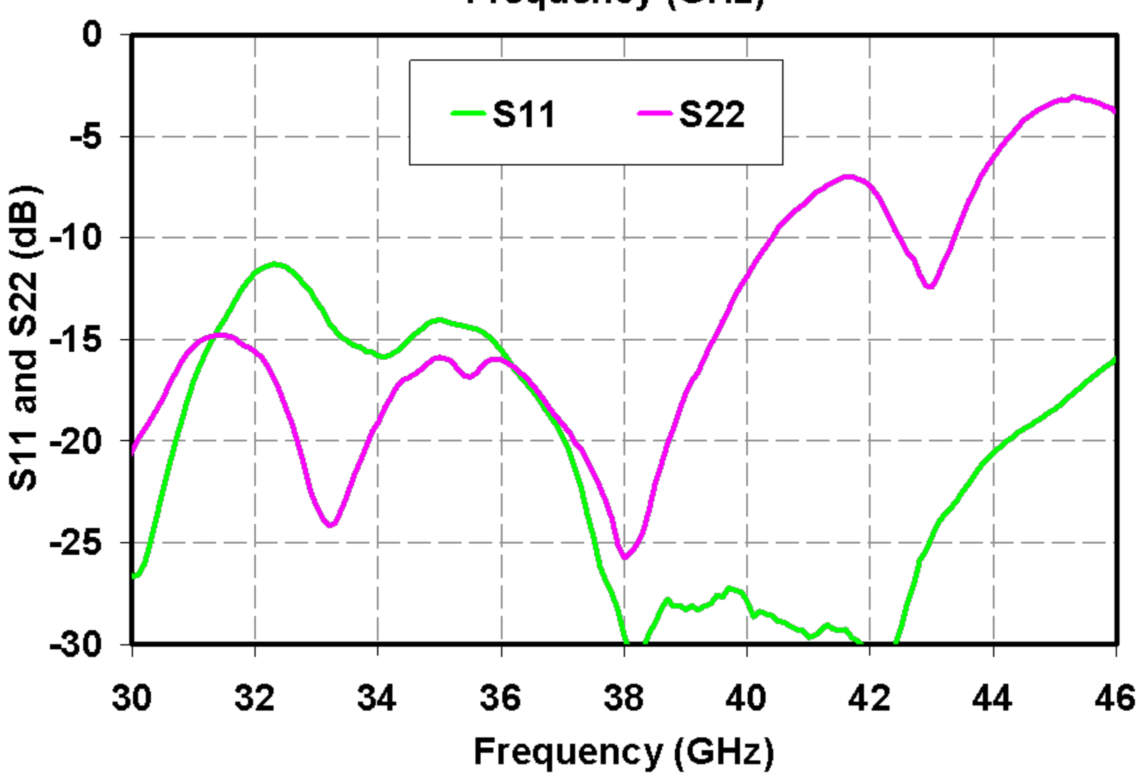
Parameter	Test Conditions	Value
Maximum Power Dissipation	Tbaseplate = 70 °C	Pd = 6.5 W Tchannel = 200 °C Tm = 7.1 E+3 Hrs
Thermal Resistance, θjc	Vd = 5 V Id = 600 mA Pd = 3.0 W	θjc = 19.9 °C/W Tchannel = 129 °C Tm = 1.1 E+7 Hrs
Thermal Resistance, θjc Under RF Drive	Vd = 5 V Id = 1000 mA Pout = 29.5 dBm Pd = 4.1 W	θjc =19.9 °C/W Tchannel = 152 °C Tm = 8.1 E+5 Hrs
Mounting Temperature	30 Seconds	320 °C
Storage Temperature		-65 to 150 °C



Measured Data

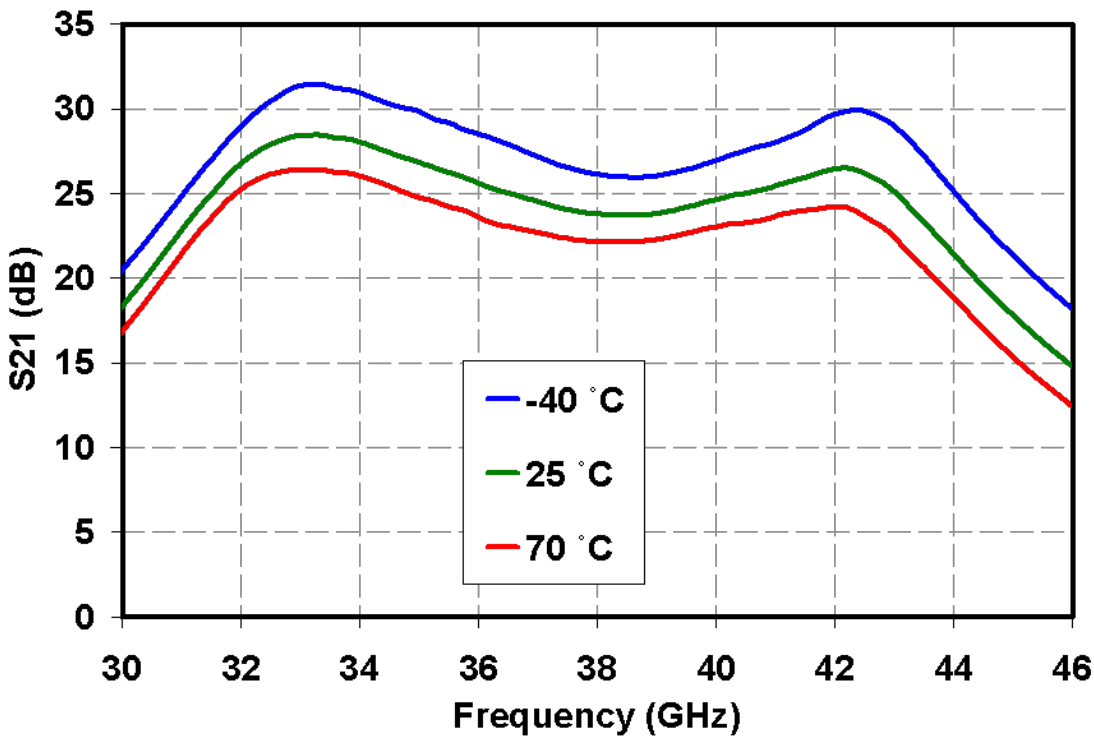
Bias conditions: Vd = 5 V, Id = 600 mA, Vg = -0.63 V Typical

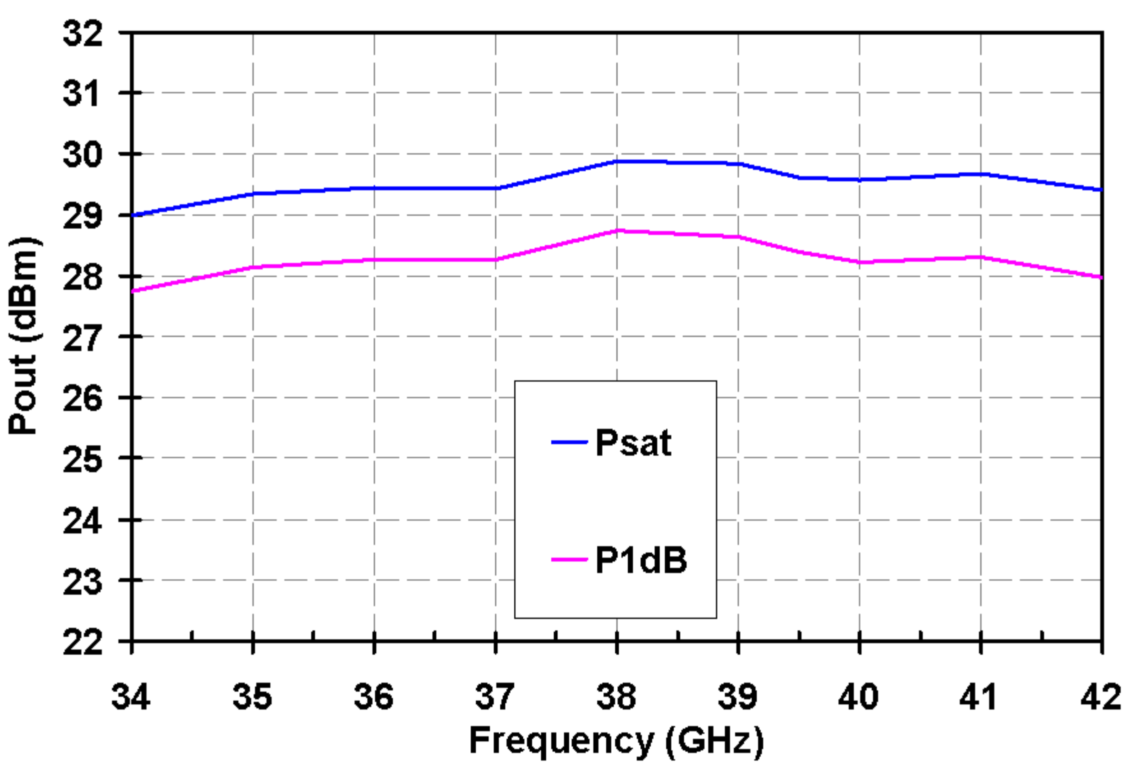




Measured Data

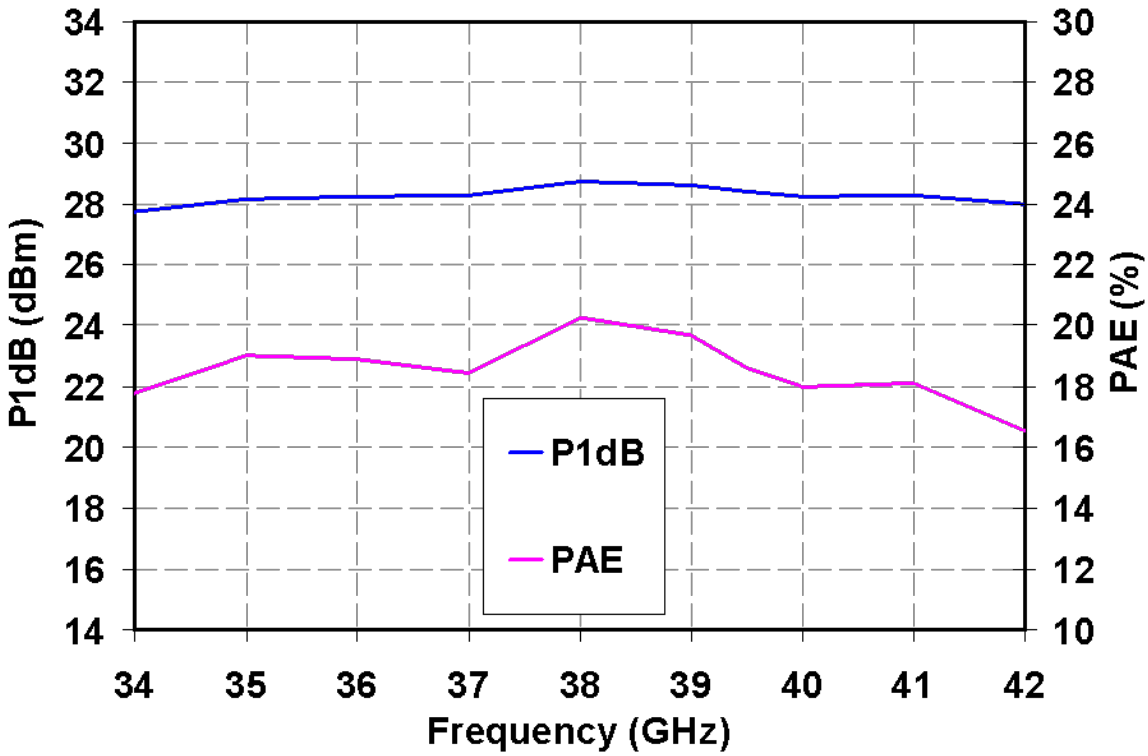
Bias conditions: Vd = 5 V, Id = 600 mA, Vg = -0.63 V Typical

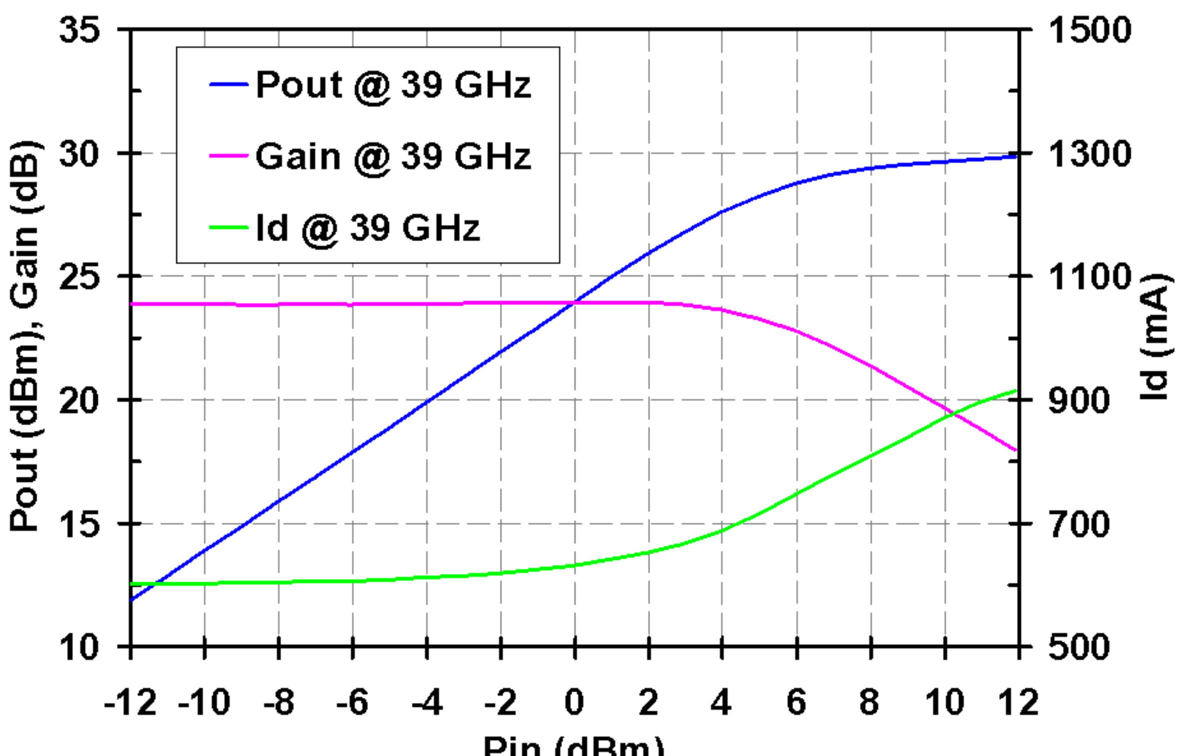




Measured Data

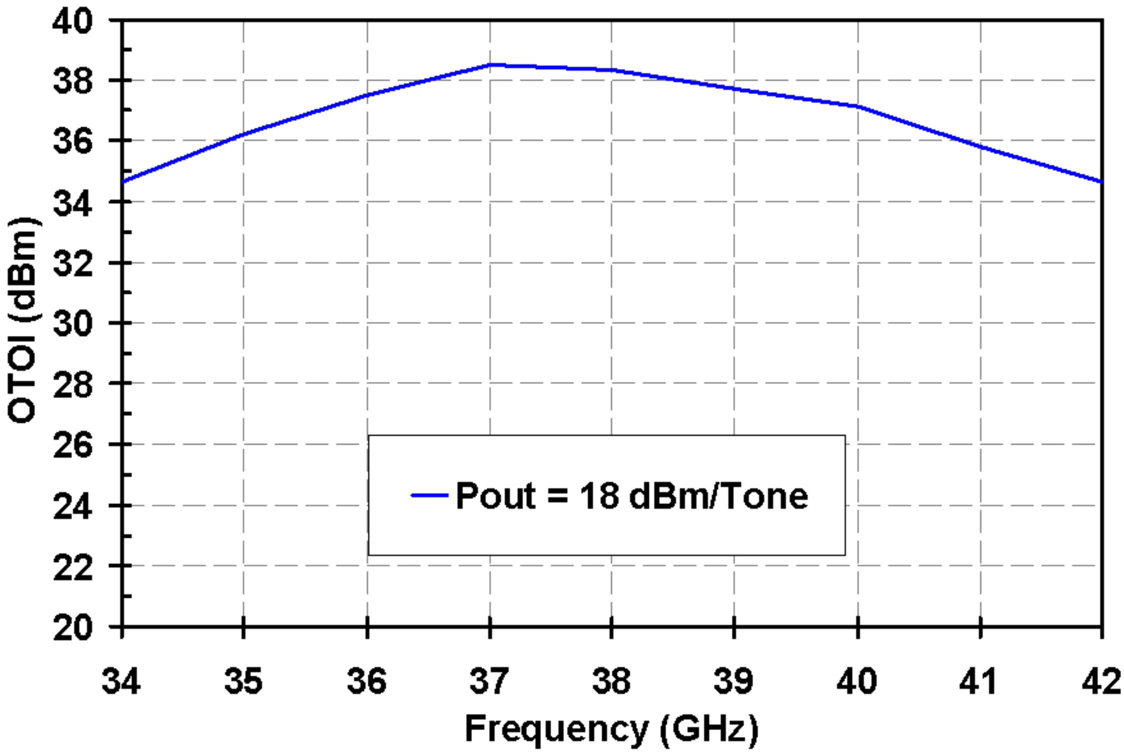
Bias conditions: Vd = 5 V, Id = 600 mA, Vg = -0.63 V Typical

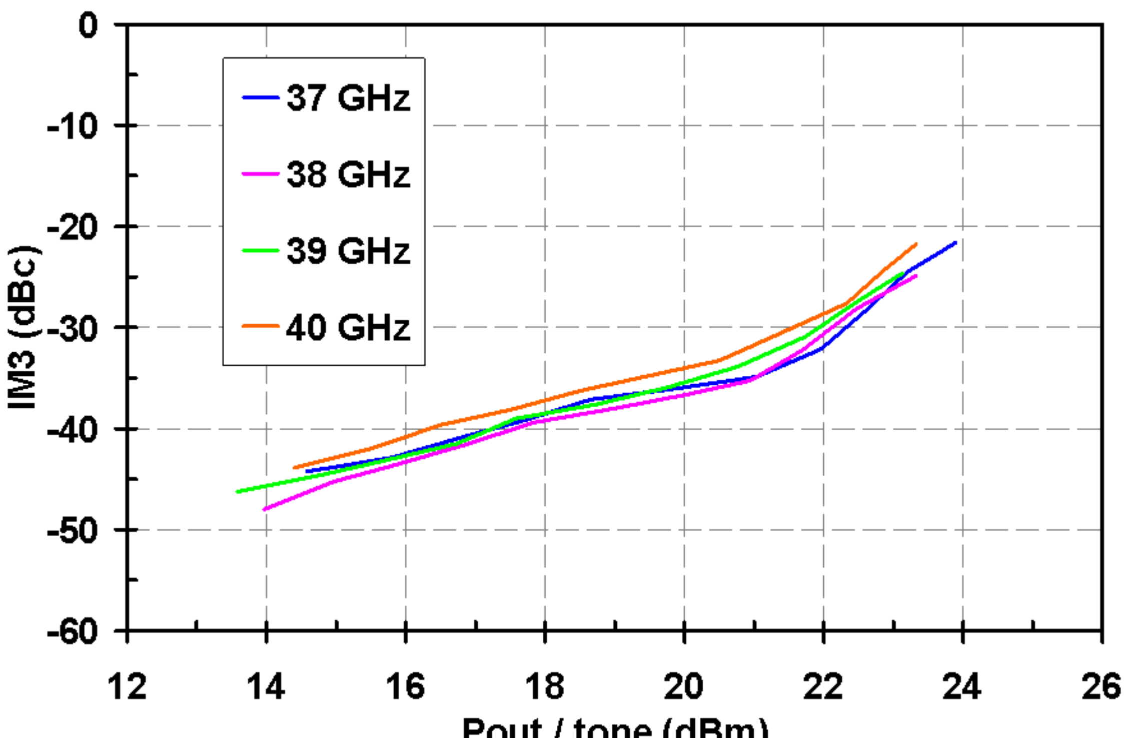




Measured Data

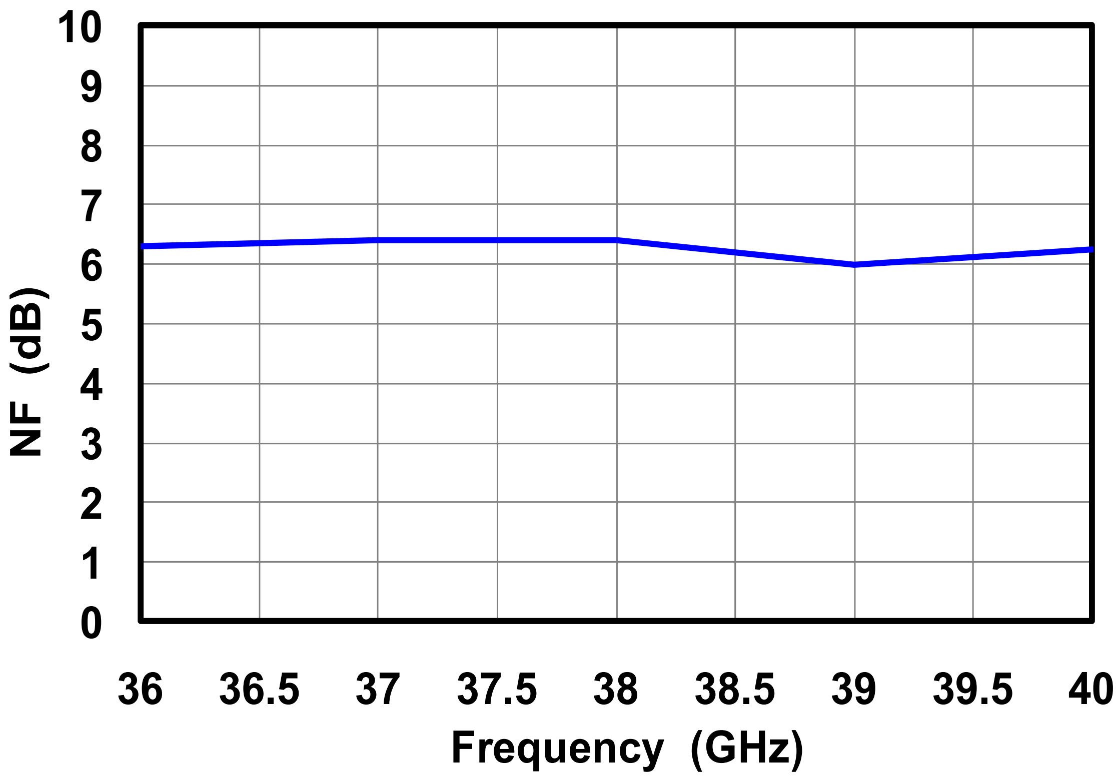
Bias conditions: Vd = 5 V, Id = 600 mA, Vg = -0.63 V Typical





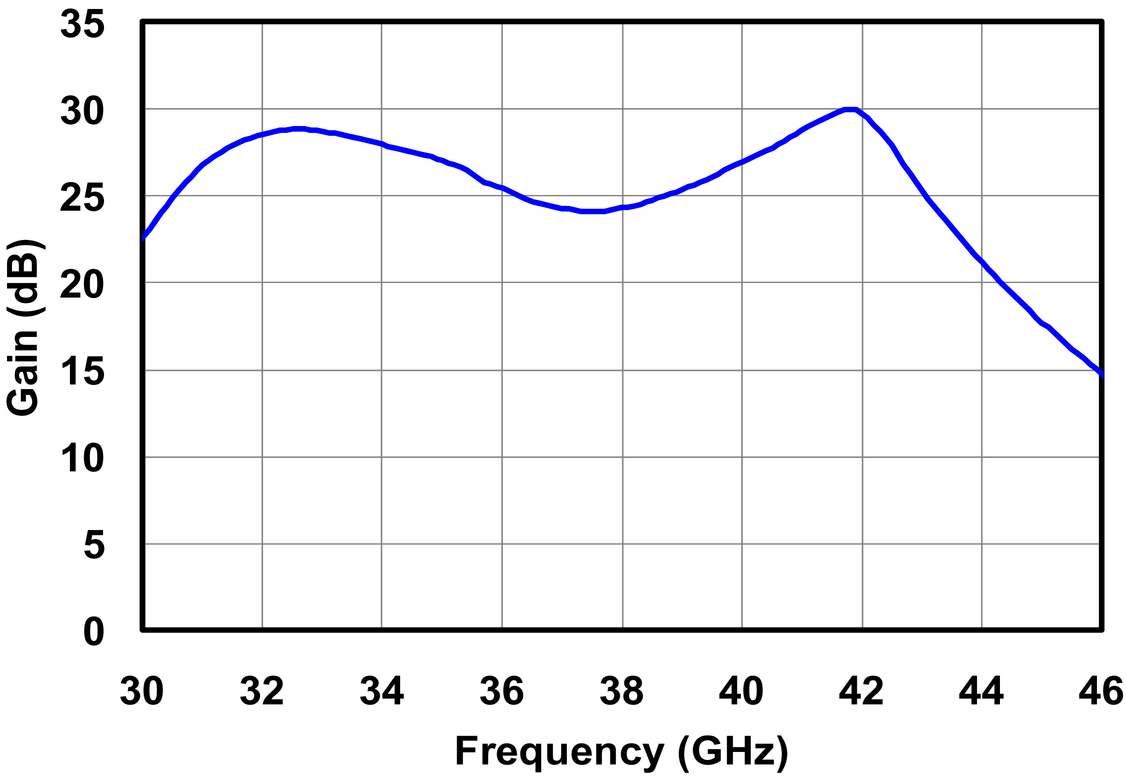
Measured Data

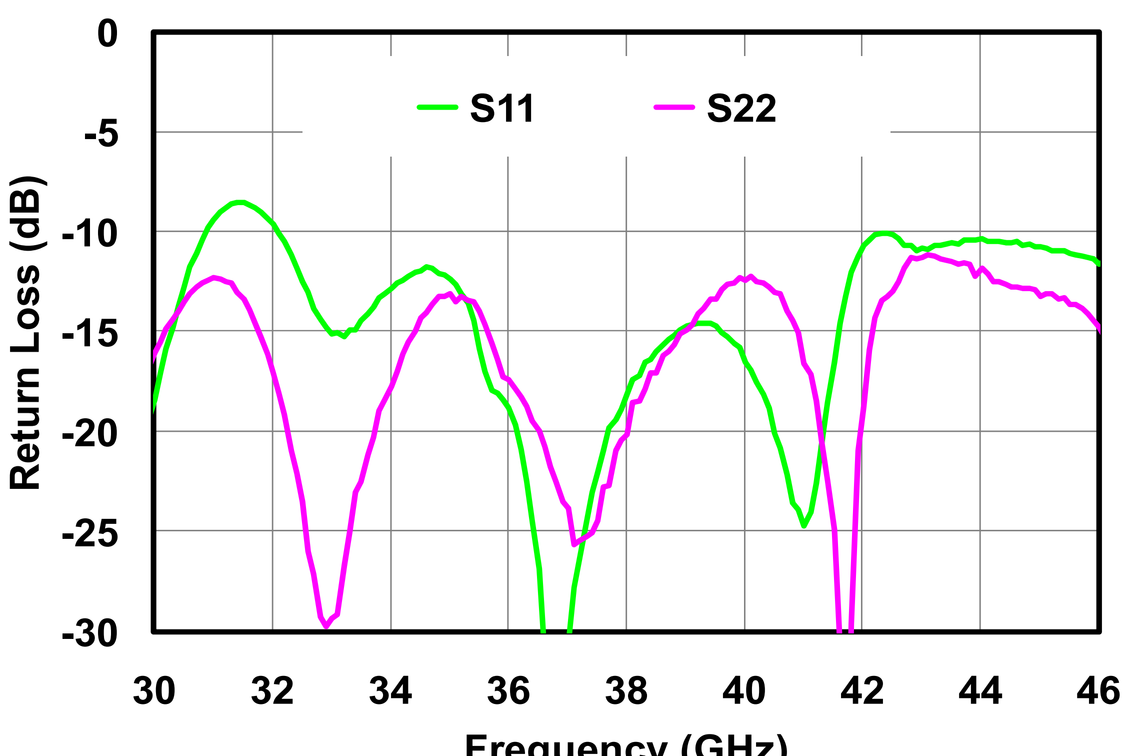
Bias conditions: Vd = 5 V, Id = 600 mA, Vg = -0.63 V Typical



Measured Data

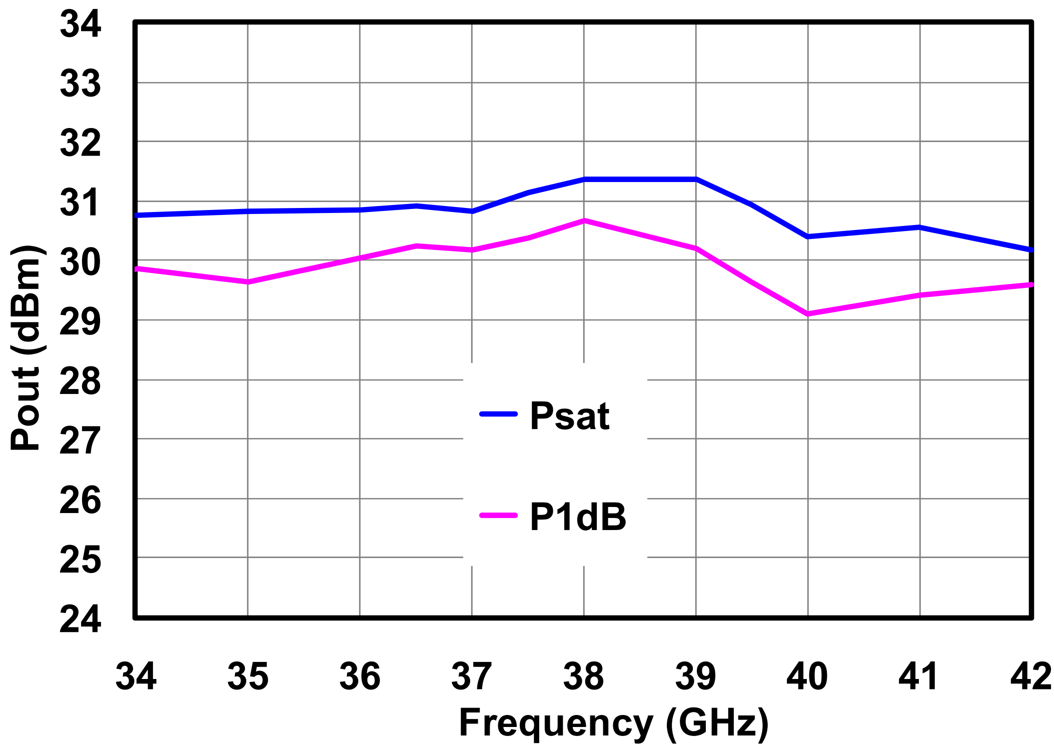
Bias conditions: Vd = 6 V, Id = 600 mA, Vg = -0.67 V Typical

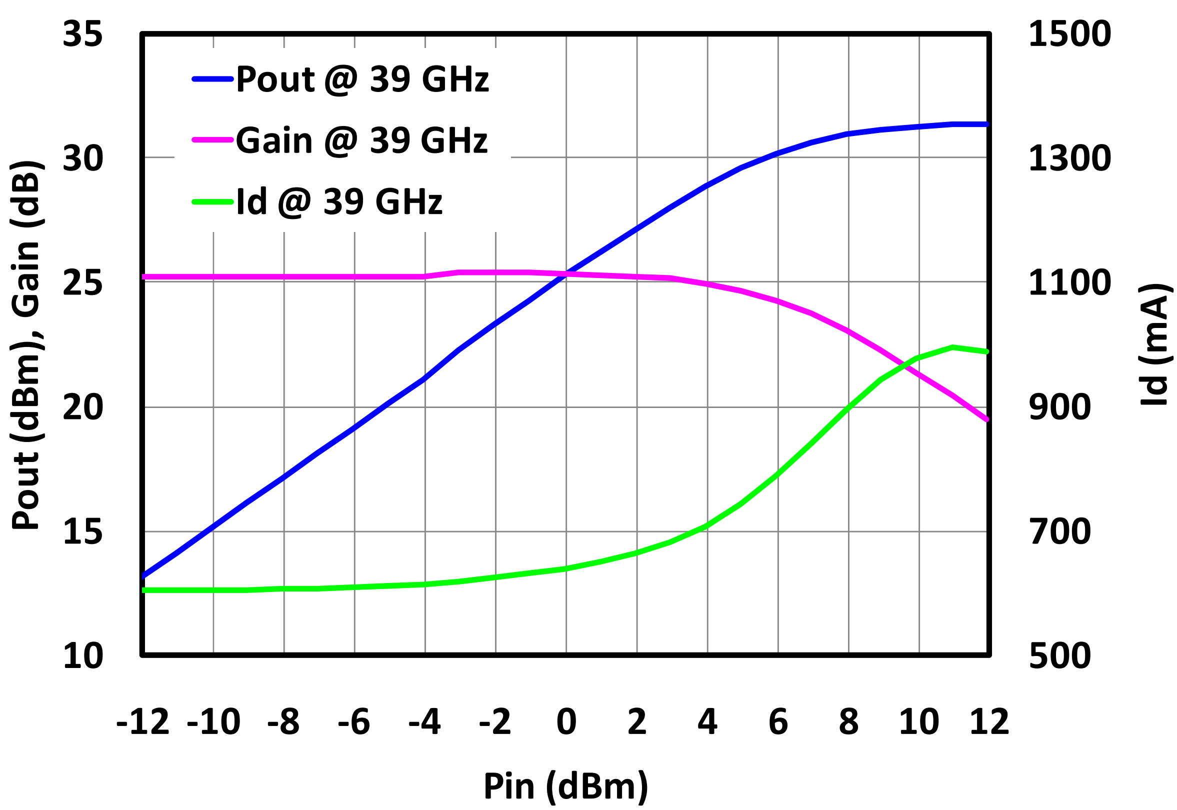




Measured Data

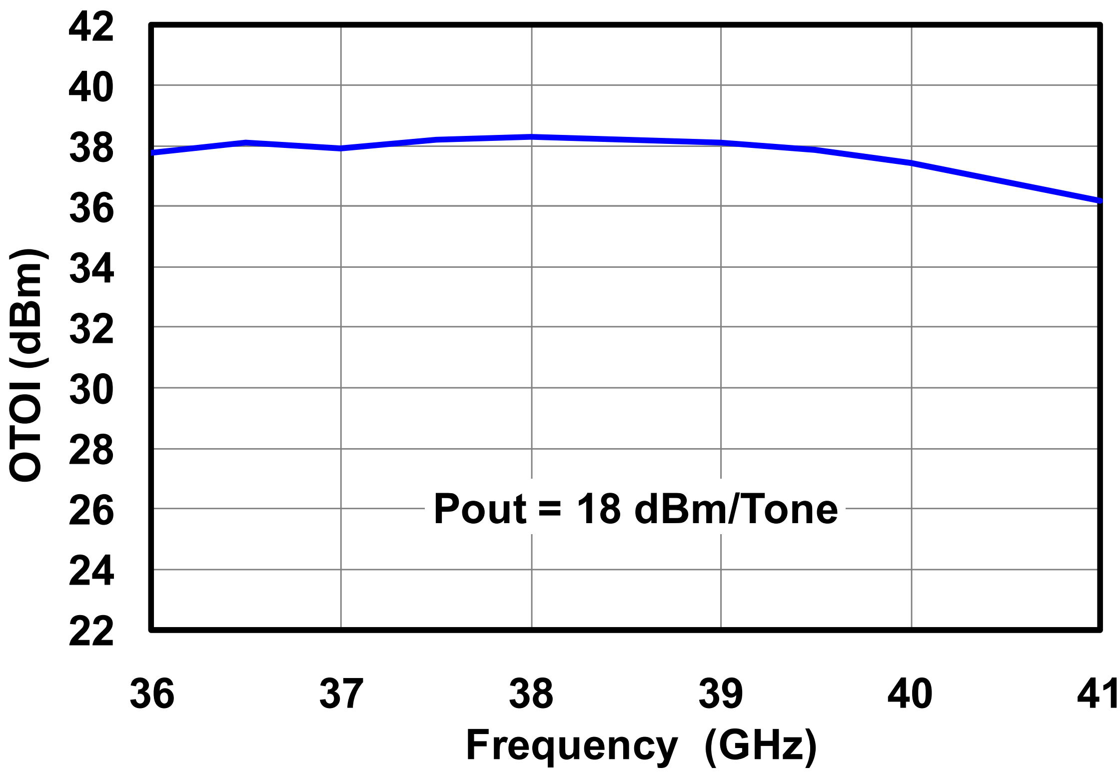
Bias conditions: Vd = 6 V, Id = 600 mA, Vg = -0.67 V Typical

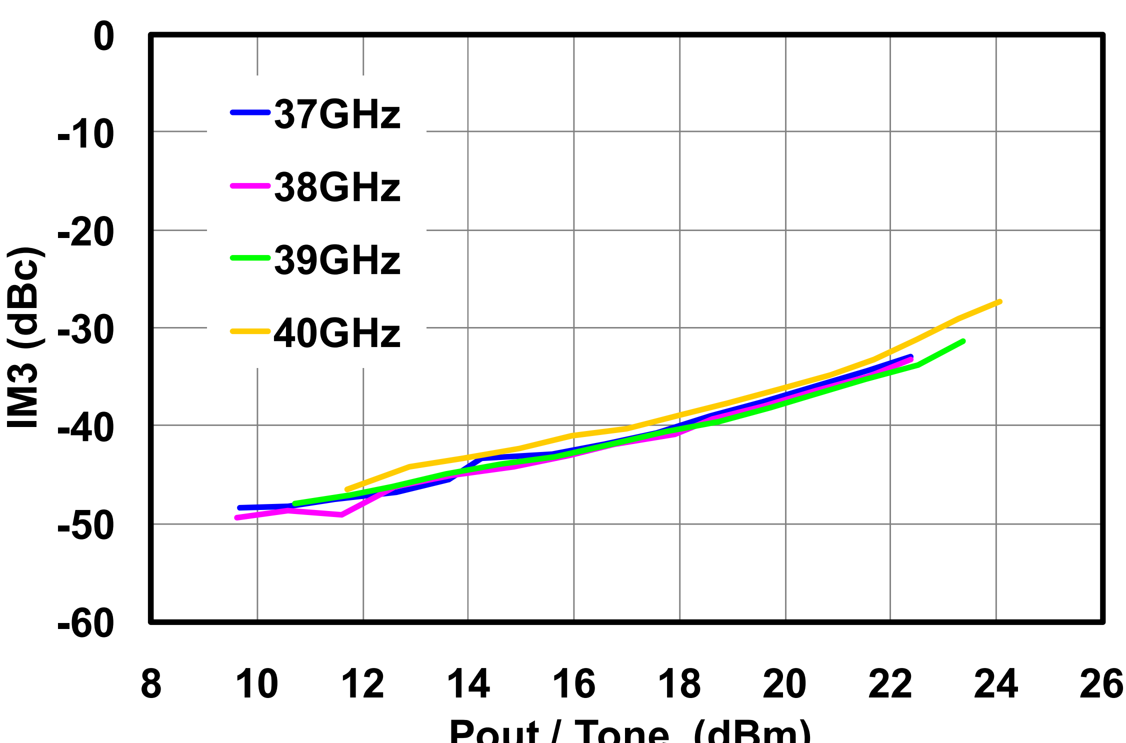




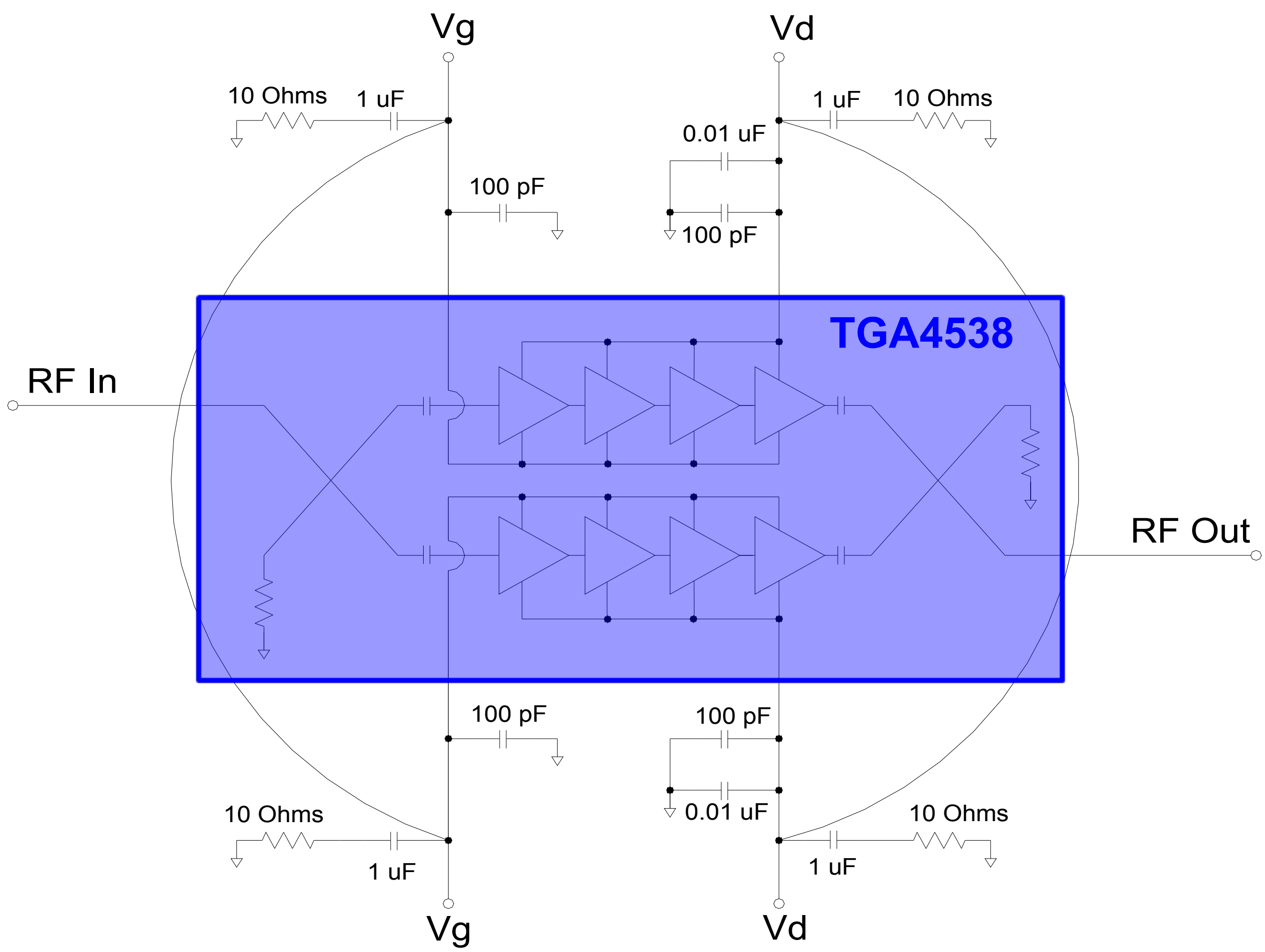
Measured Data

Bias conditions: Vd = 6 V, Id = 600 mA, Vg = -0.67 V Typical





Electrical Schematic



Bias Procedures

Bias-up Procedure

Vg set to -1.5 V

Vd set to +5 V or +6 V

Adjust Vg more positive until Idq is 600 mA.

Apply RF signal

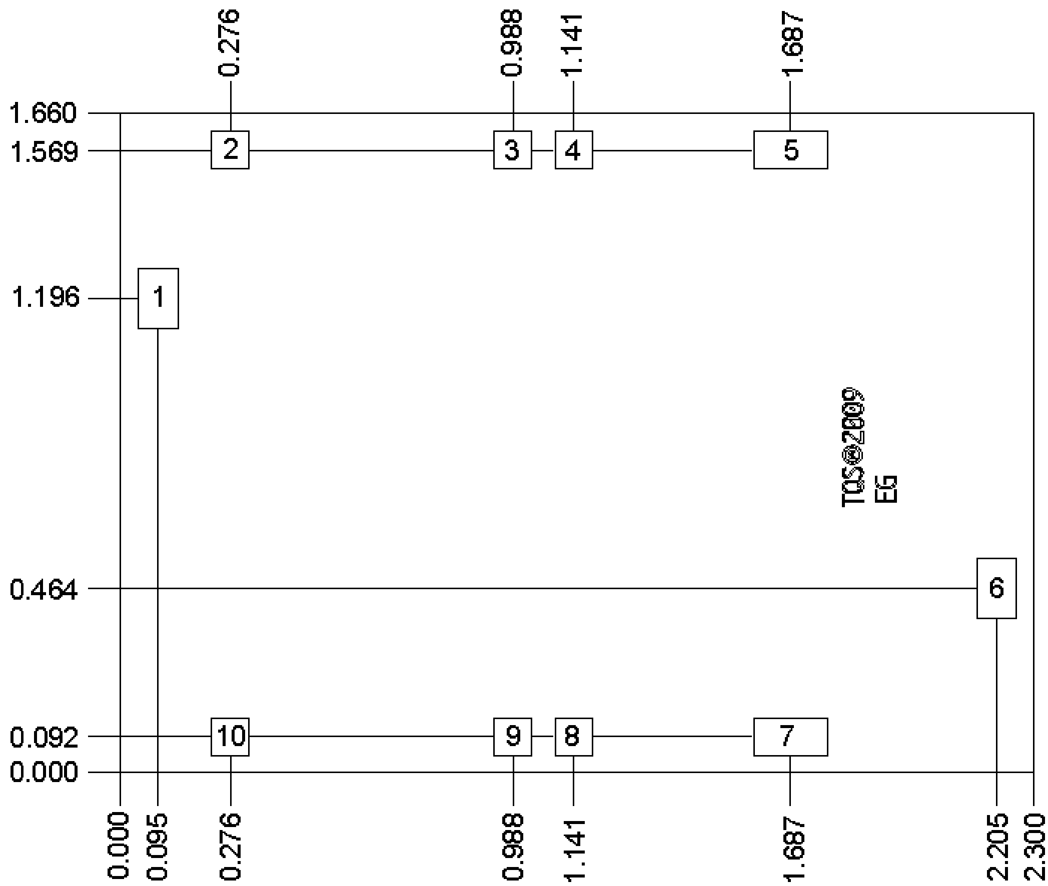
Bias-down Procedure

Turn off RF supply

Reduce Vg to -1.5 V. Ensure Id ~ 0 mA

Turn Vd to 0 V

Mechanical Drawing

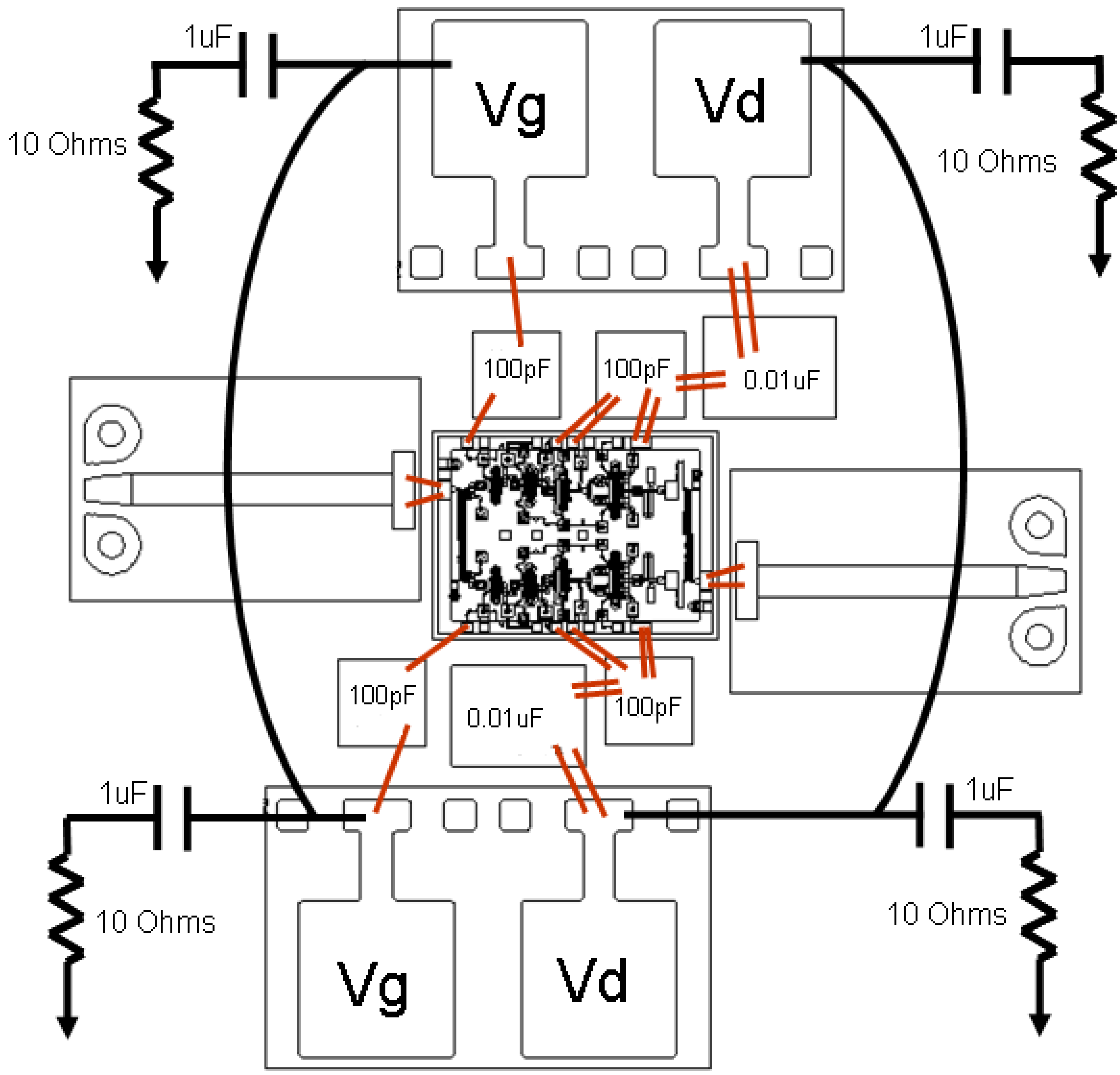


Units: millimeters
Thickness: 0.10
Die x, y size tolerance: +/ - 0.050
Chip edge to bond pad dimensions are shown to center of pad
Ground is backside of die

Bond Pad # 1	RF In	0.082 x 0.132	Bond Pad # 6	RF Out	0.082 x 0.132
Bond Pad # 2, 10	Vg	0.075 x 0.075	Bond Pad # 5, 7	Vd3	0.168 x 0.075
Bond Pad # 3, 9	Vd1	0.075 x 0.075	Bond Pad # 4, 8	Vd2	0.075 x 0.075

GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.

Recommended Assembly Diagram



GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.

Assembly Notes

Component placement and adhesive attachment assembly notes:

- Vacuum pencils and/or vacuum collets are the preferred method of pick up.
- Air bridges must be avoided during placement.
- The force impact is critical during auto placement.
- Organic attachment (i.e. epoxy) can be used in low-power applications.
- Curing should be done in a convection oven; proper exhaust is a safety concern.

Reflow process assembly notes:

- Use AuSn (80/20) solder and limit exposure to temperatures above 300°C to 3-4 minutes, maximum.
- An alloy station or conveyor furnace with reducing atmosphere should be used.
- Do not use any kind of flux.
- Coefficient of thermal expansion matching is critical for long-term reliability.
- Devices must be stored in a dry nitrogen atmosphere.

Interconnect process assembly notes:

- Thermosonic ball bonding is the preferred interconnect technique.
- Force, time, and ultrasonics are critical parameters.
- Aluminum wire should not be used.
- Devices with small pad sizes should be bonded with 0.0007-inch wire.

Ordering Information

Part	ECCN	Package Style
TGA4538	3A001.b.2.e	GaAs MMIC Die

GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.