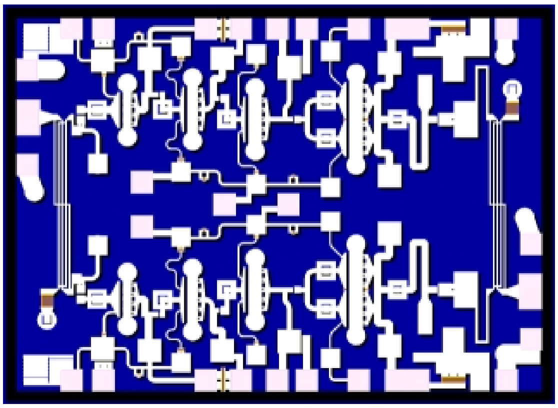
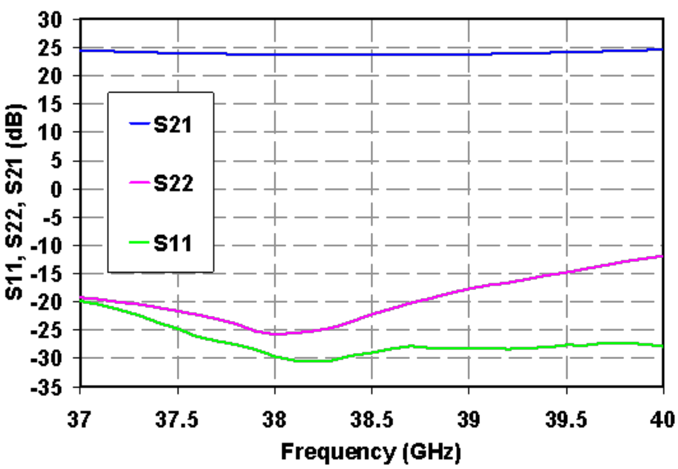
TGA4538

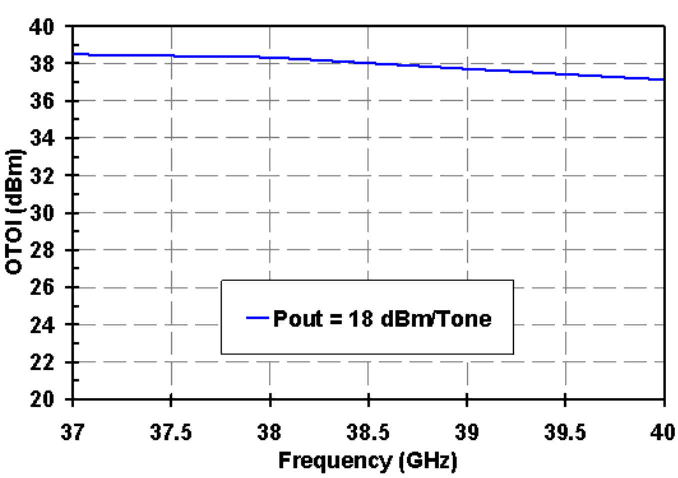
37 - 40 GHz Power Amplifier



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

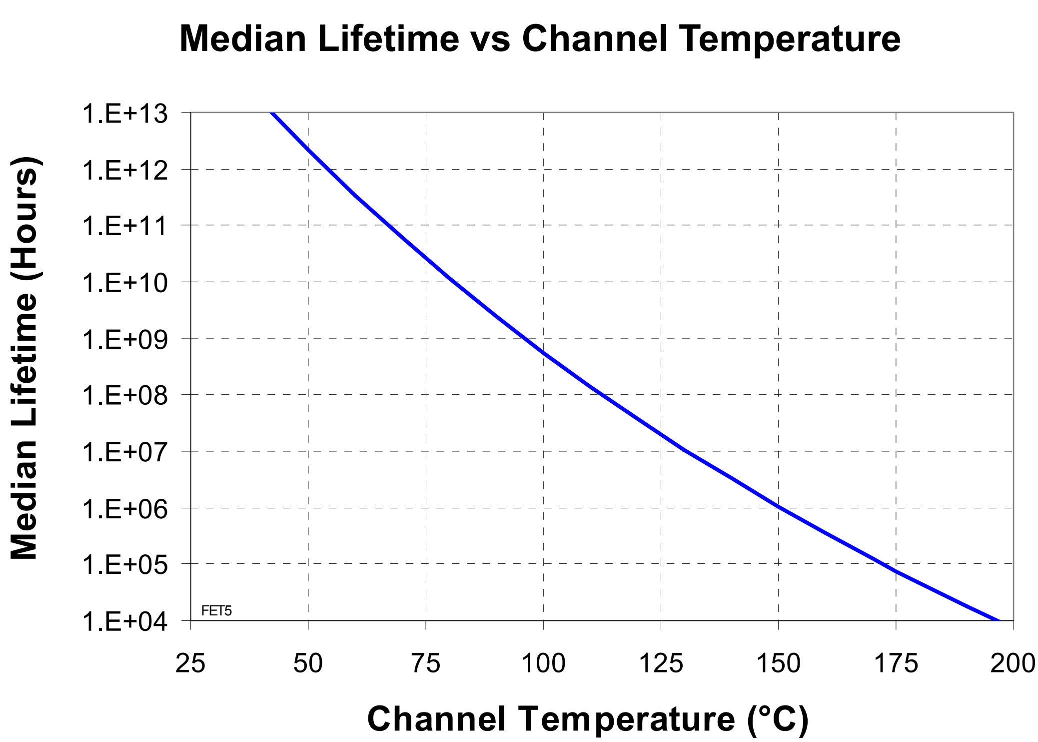
SYMBOL	PARAMETER	TEST CONDITIONS	MIN	NOMINAL	MAX	UNITS
Gain	Small Signal Gain	f = 37 - 40 GHz	23	25		dB
IRL	Input Return Loss	f = 37 - 40 GHz		20		dB
ORL	Output Return Loss	f = 37 - 40 GHz		15		dB
Psat	Saturated Output Power	f = 37 - 40 GHz		29.5		dBm
P1dB	Output Power @ 1dB compression	f = 37 - 40 GHz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

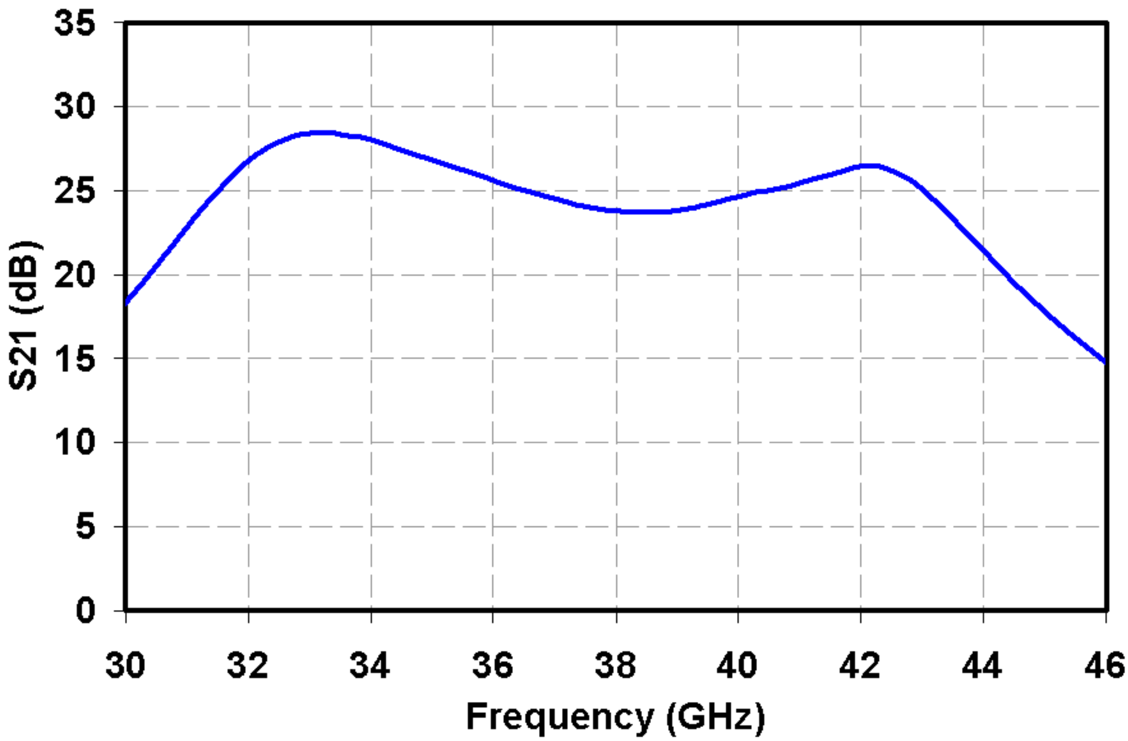
Table IV
Power Dissipation and Thermal Properties

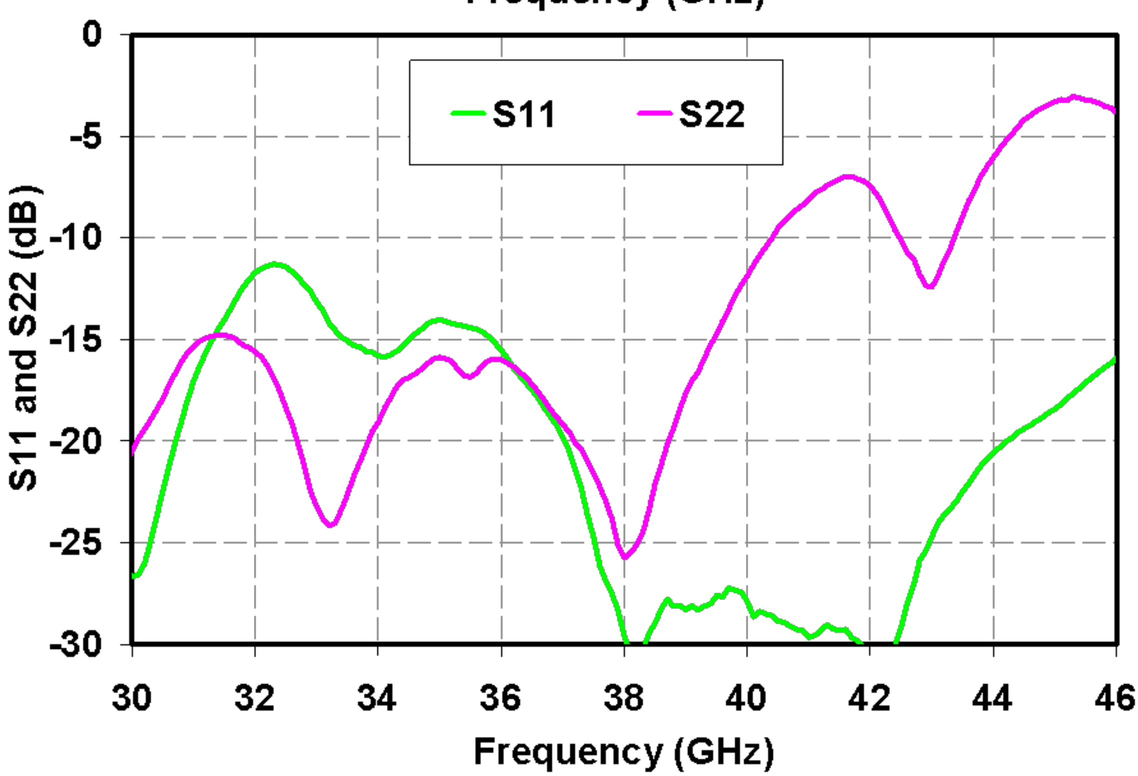
Parameter	Test Conditions	Value
Maximum Power Dissipation	Tbaseplate = 70 °C	Pd = 6.5 W Tchannel = 200 °C Tm = 7.1 E+3 Hrs
Thermal Resistance, θjc	Vd = 5 V Id = 600 mA Pd = 3.0 W	θjc = 19.9 °C/W Tchannel = 129 °C Tm = 1.1 E+7 Hrs
Thermal Resistance, θjc Under RF Drive	Vd = 5 V Id = 1000 mA Pout = 29.5 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





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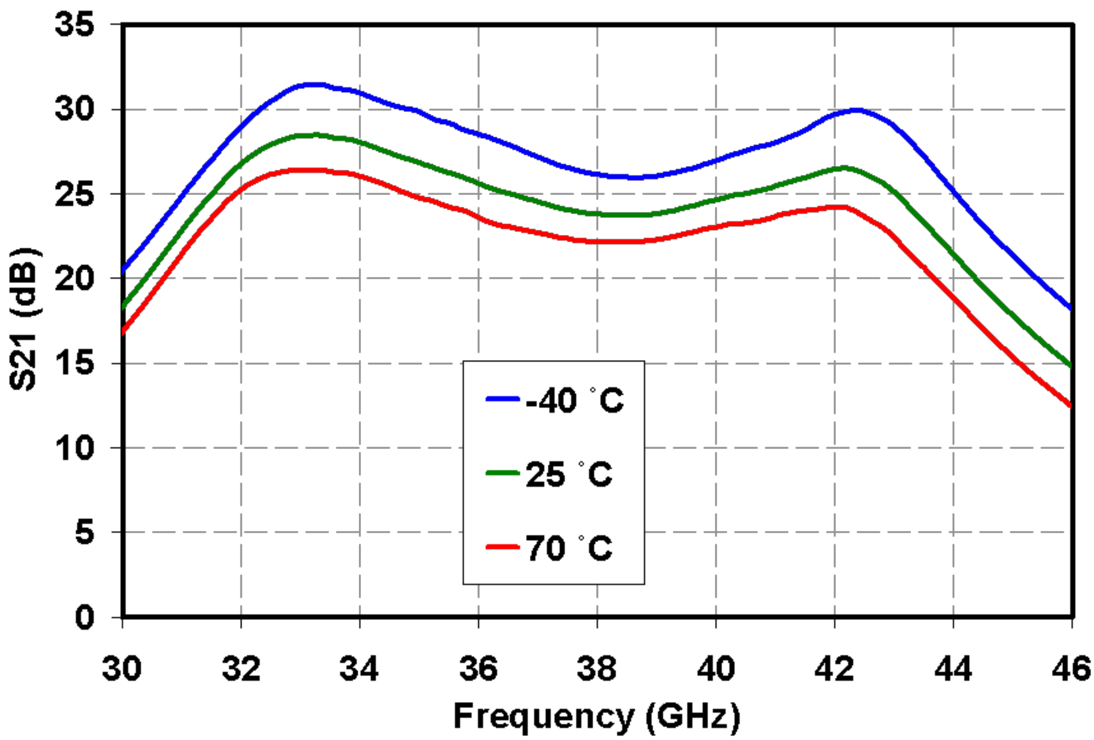

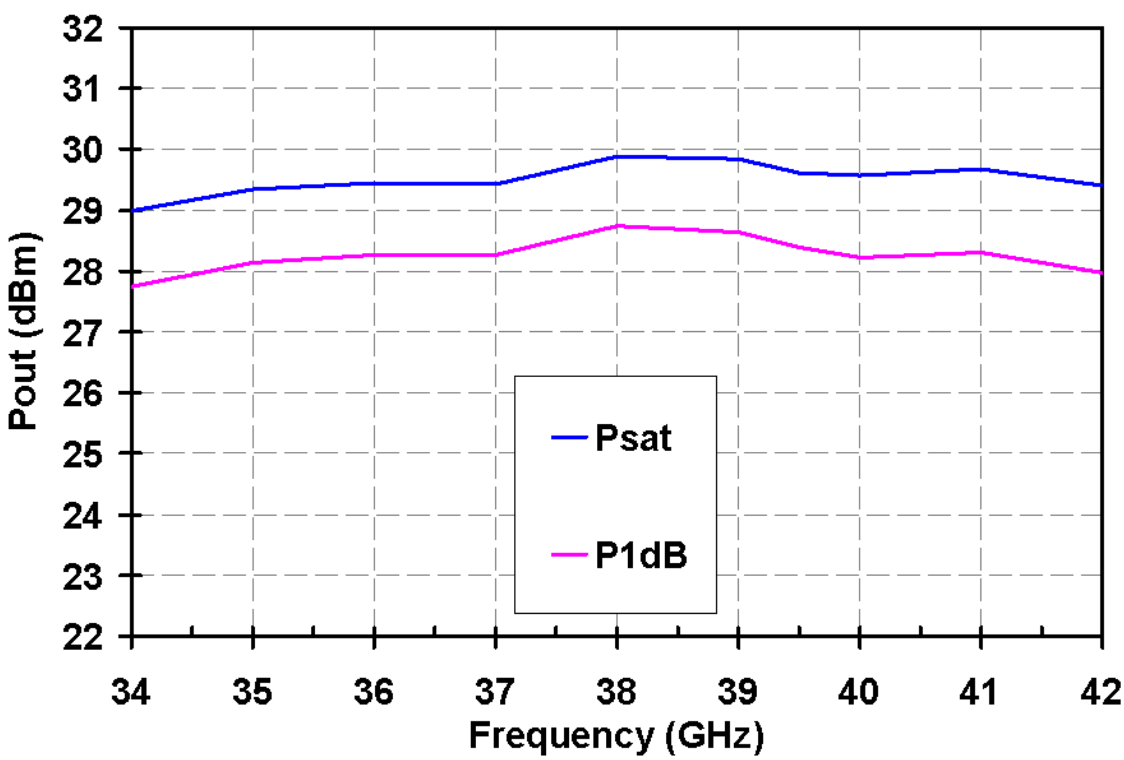

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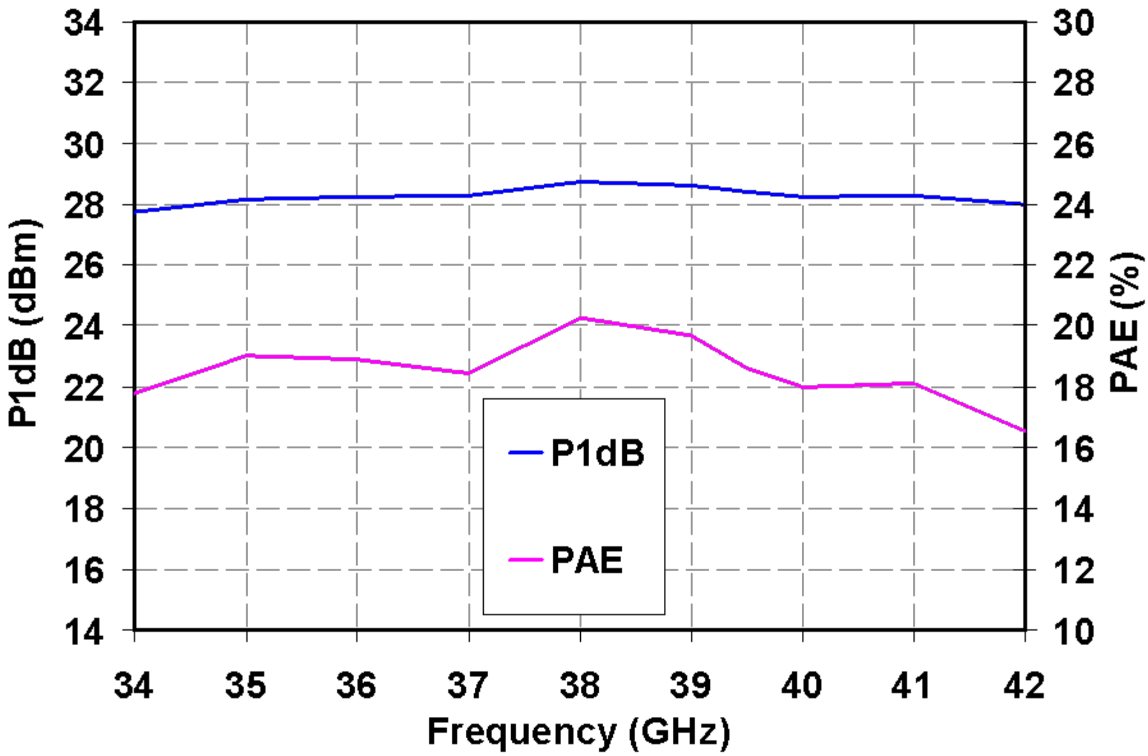

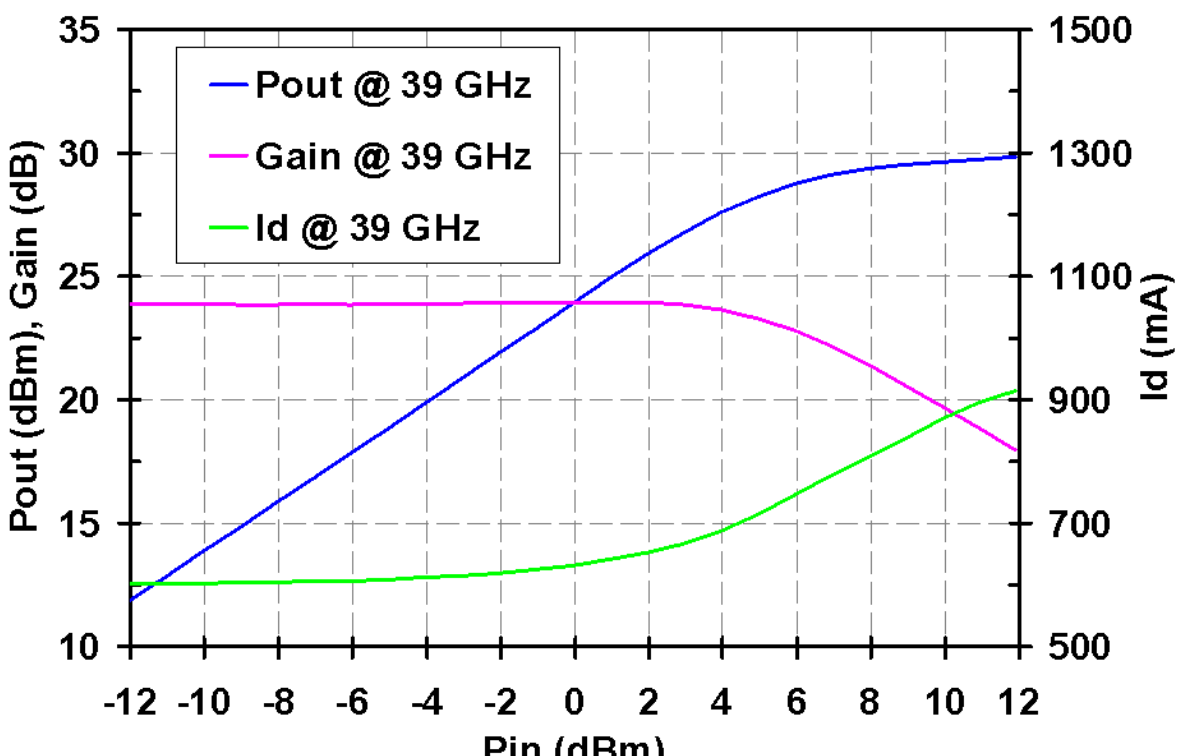

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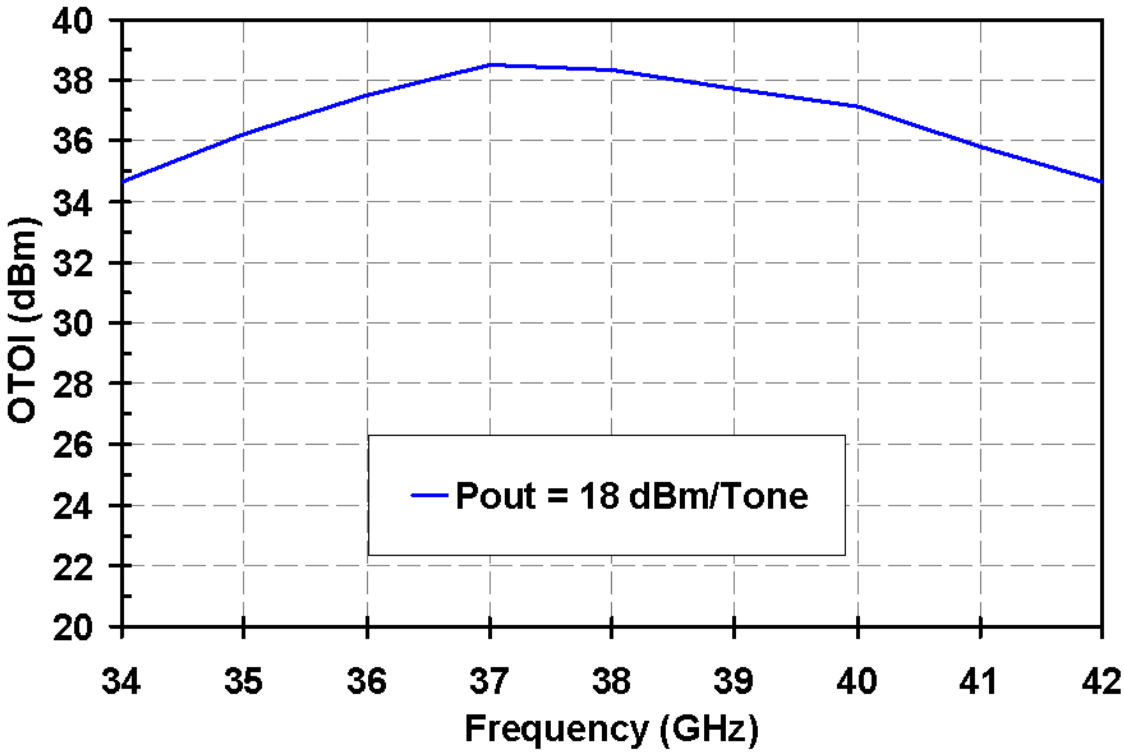

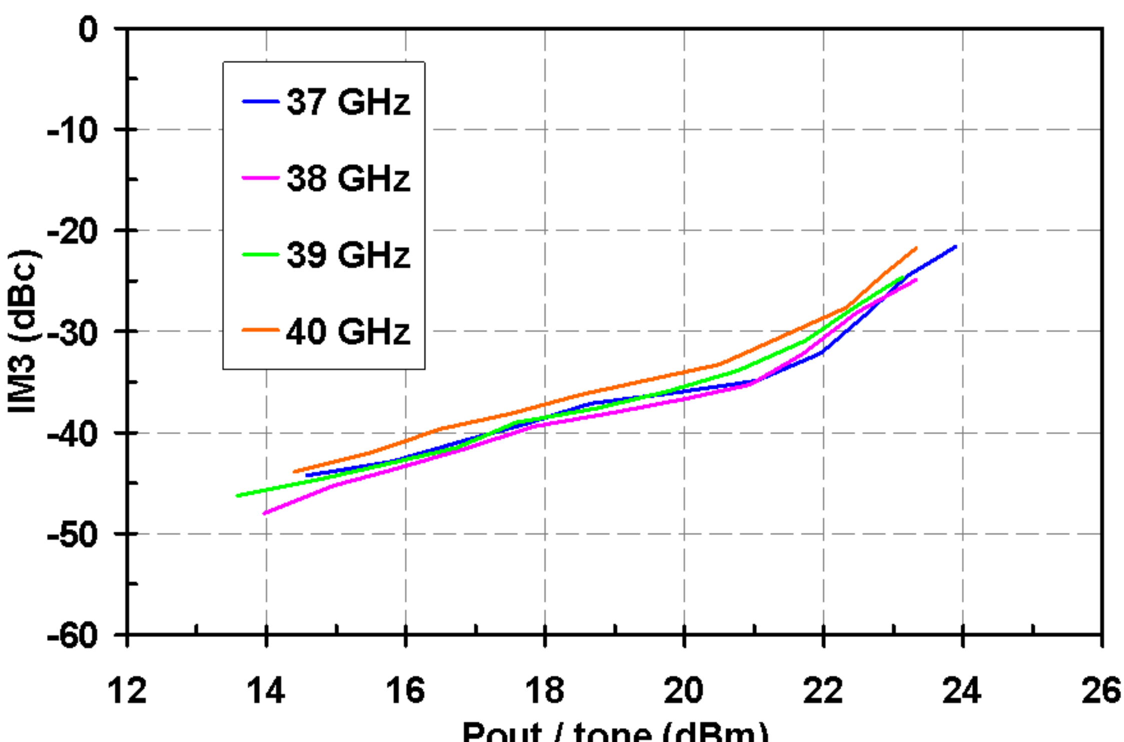

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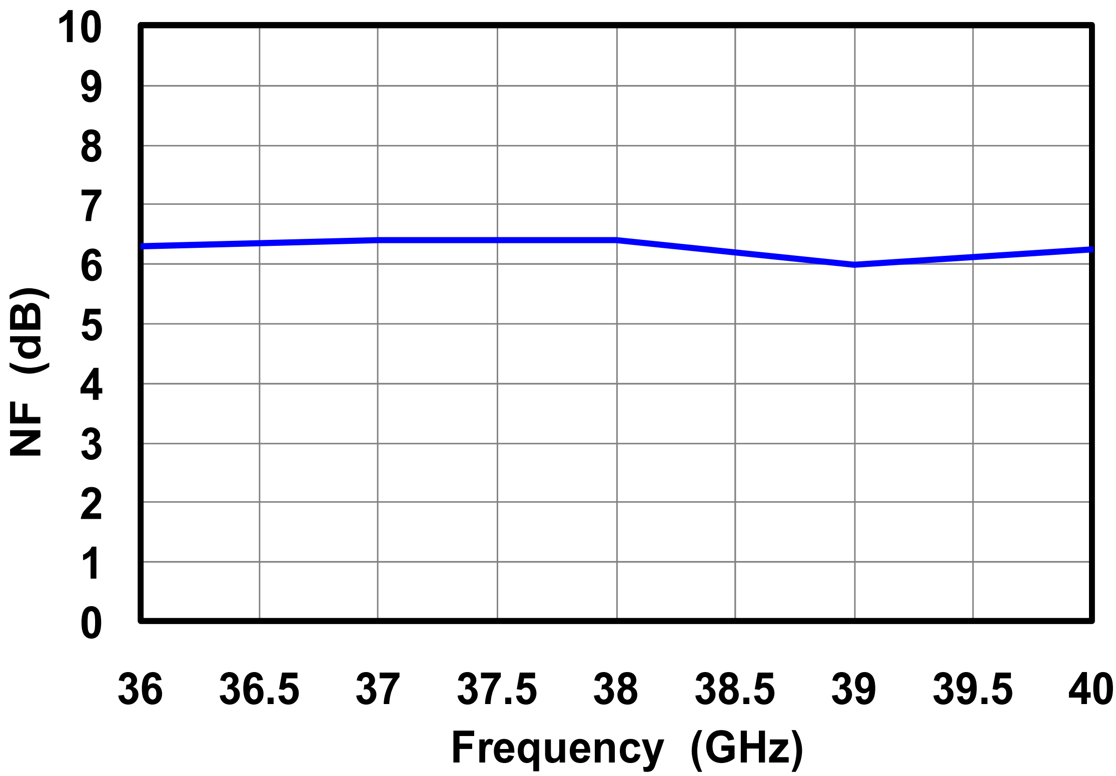
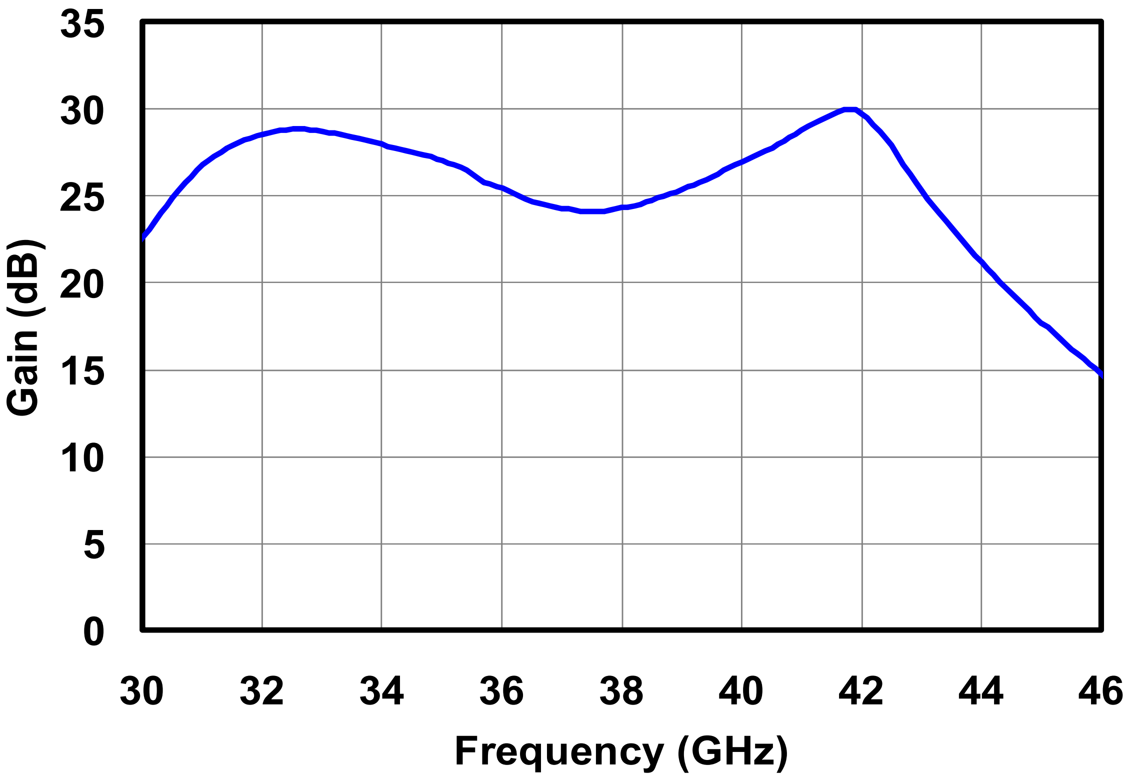
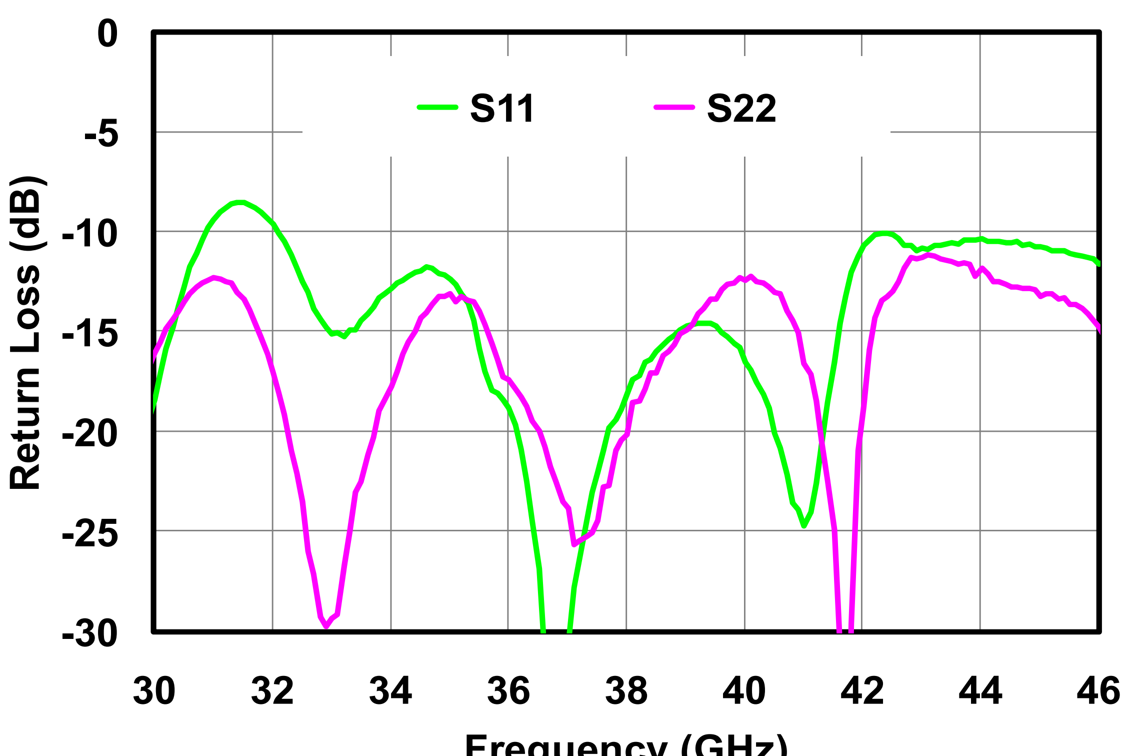


Measured Data

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





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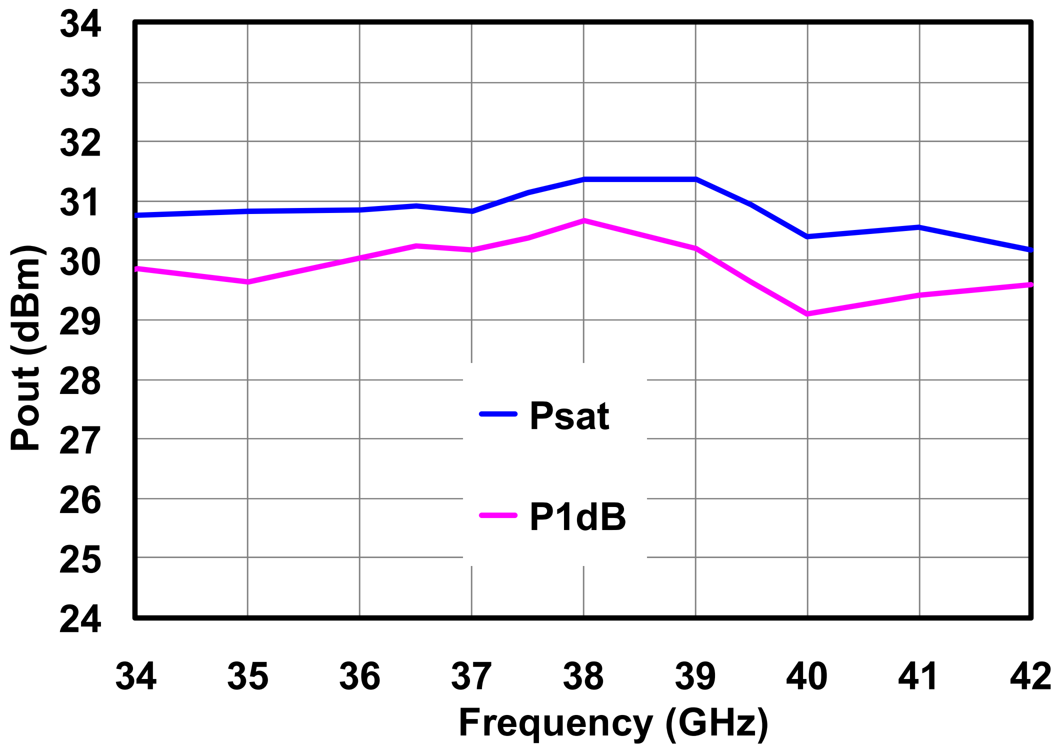

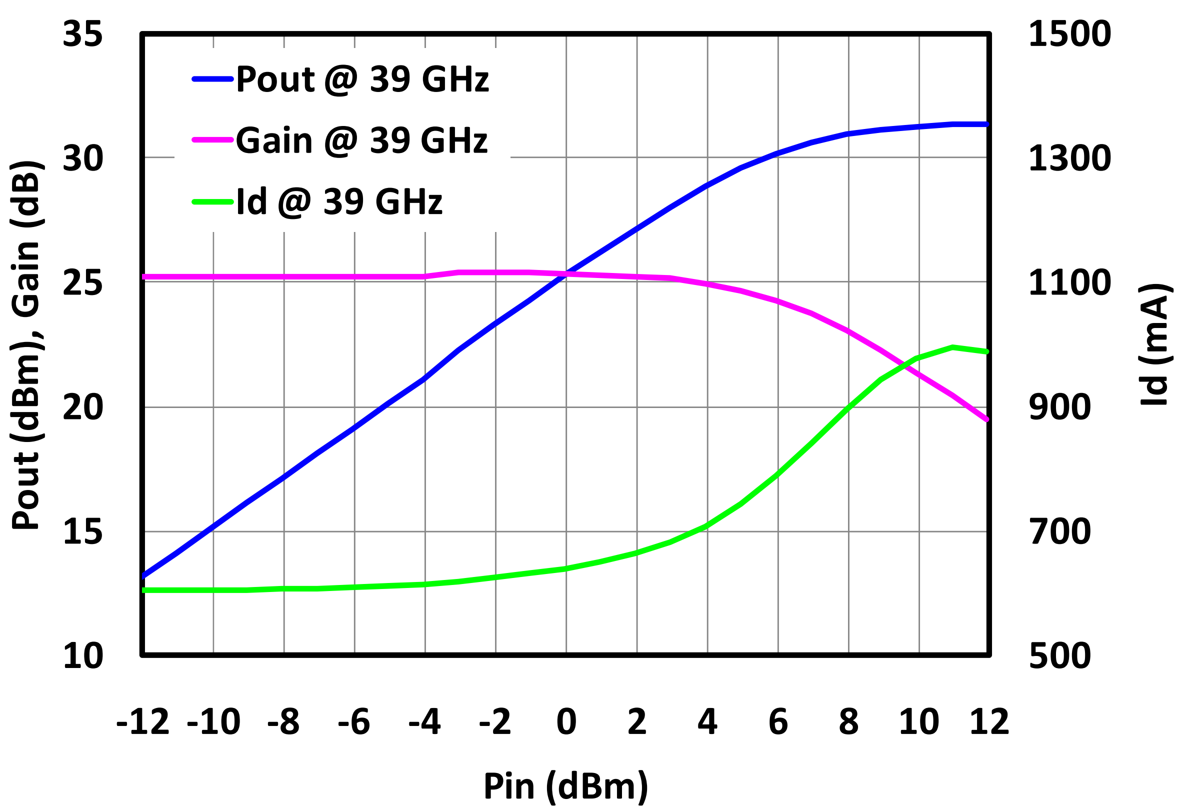

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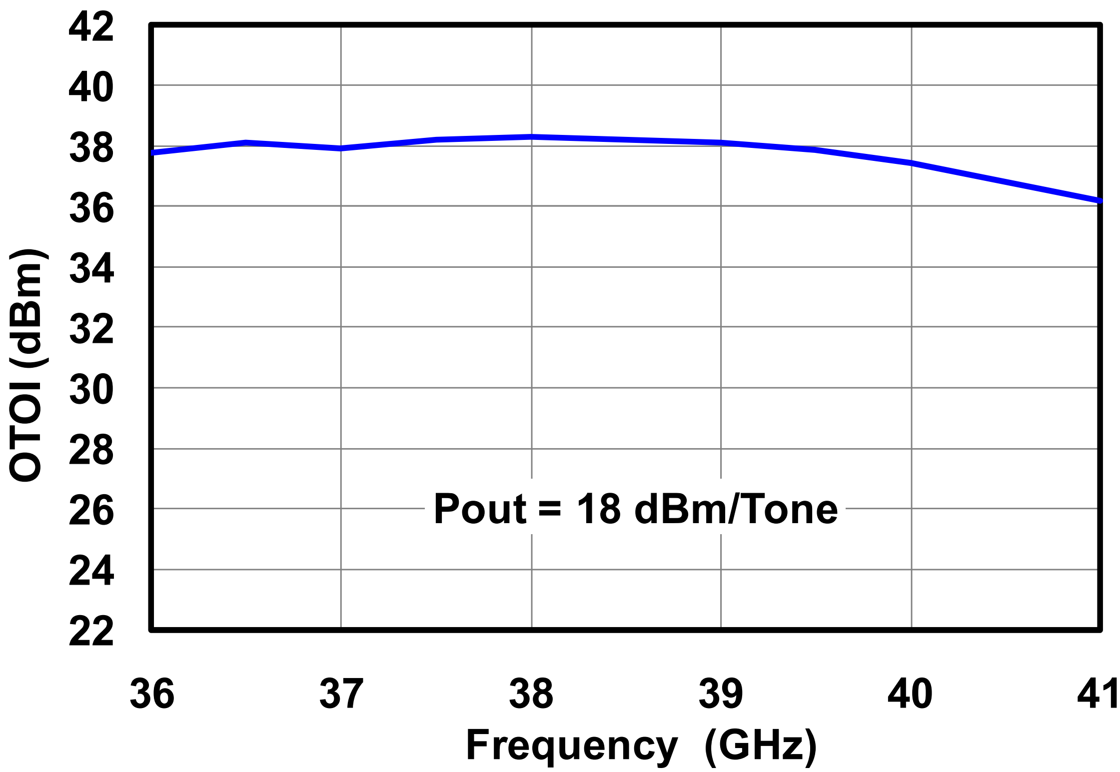
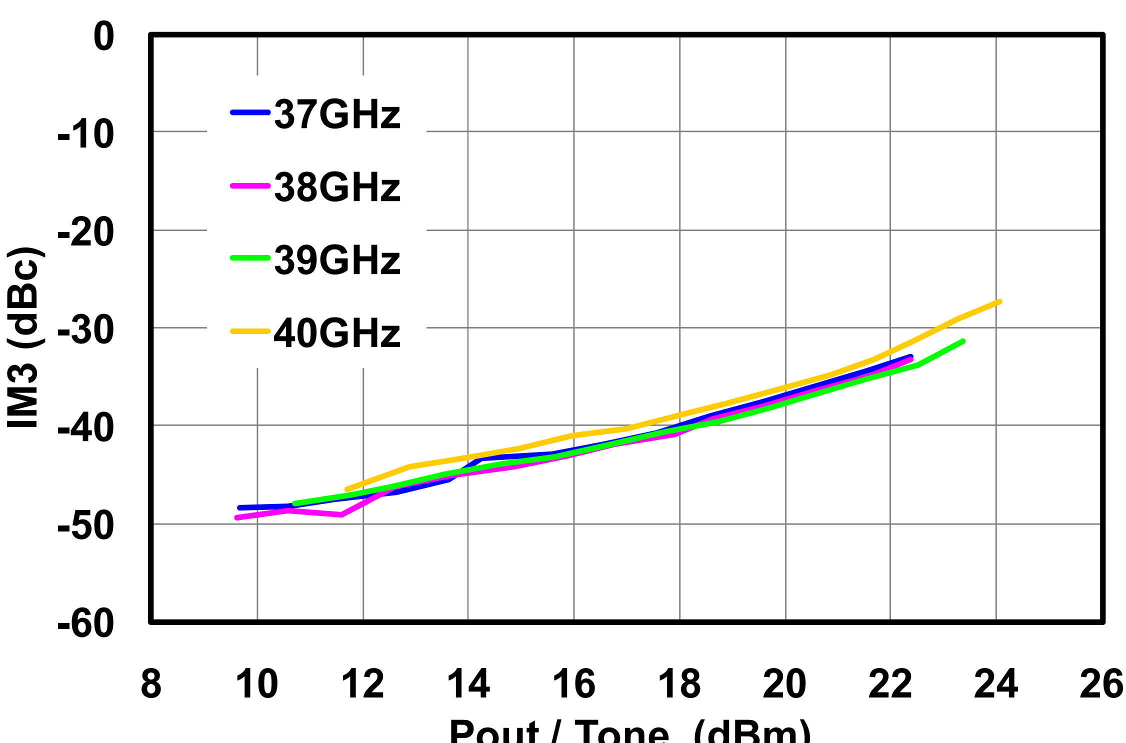
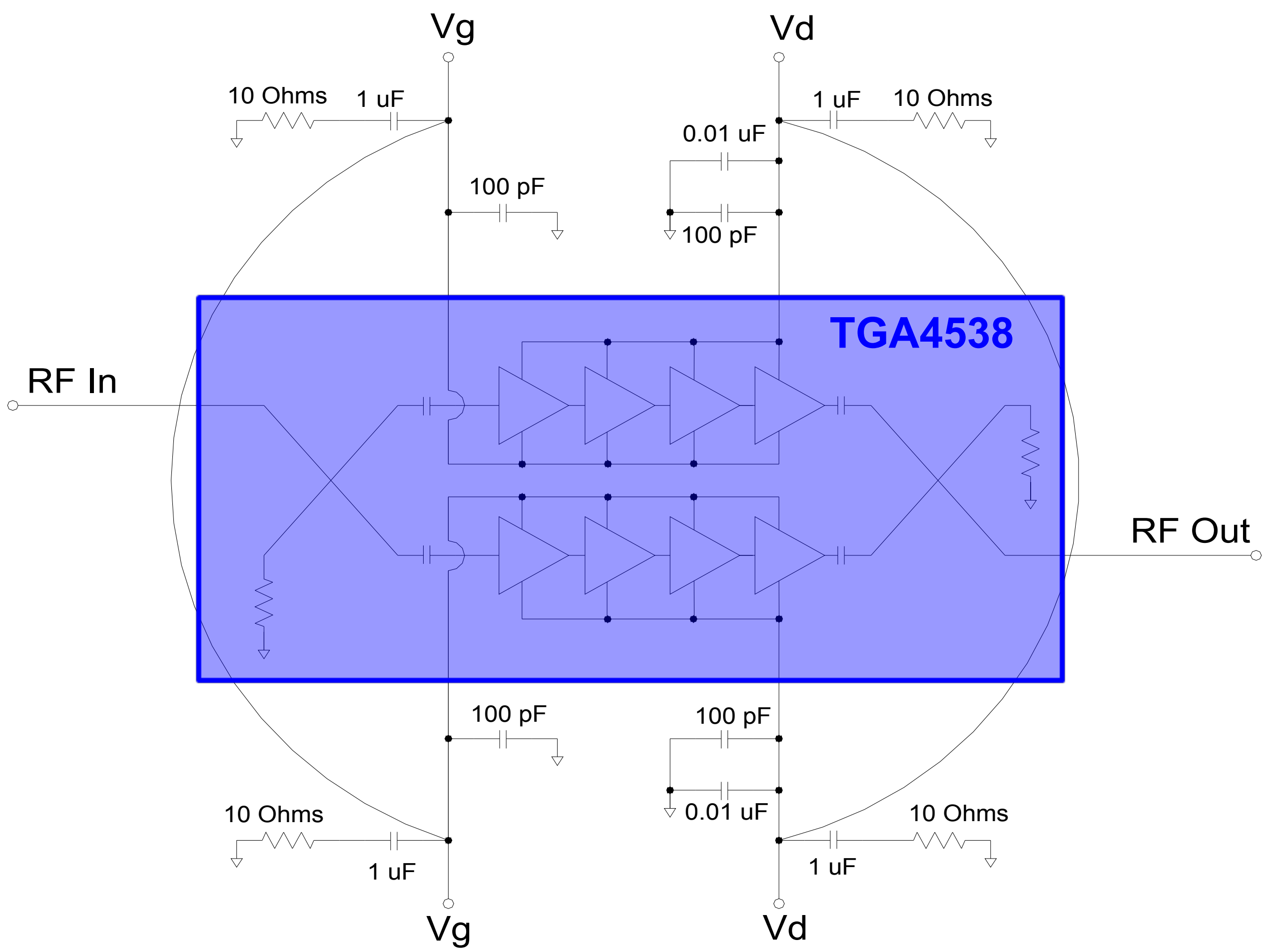




Electrical Schematic



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

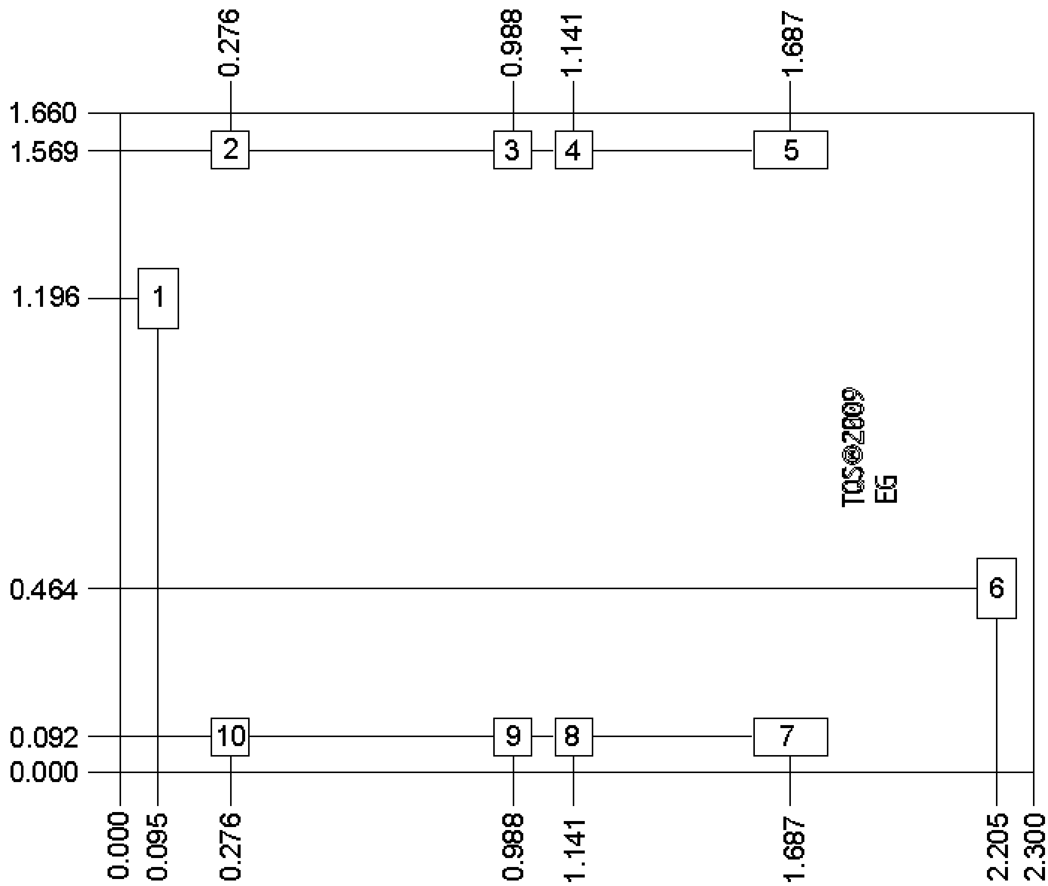
Bias-down Procedure

Turn off RF supply

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

Turn Vd to 0 V

Mechanical Drawing

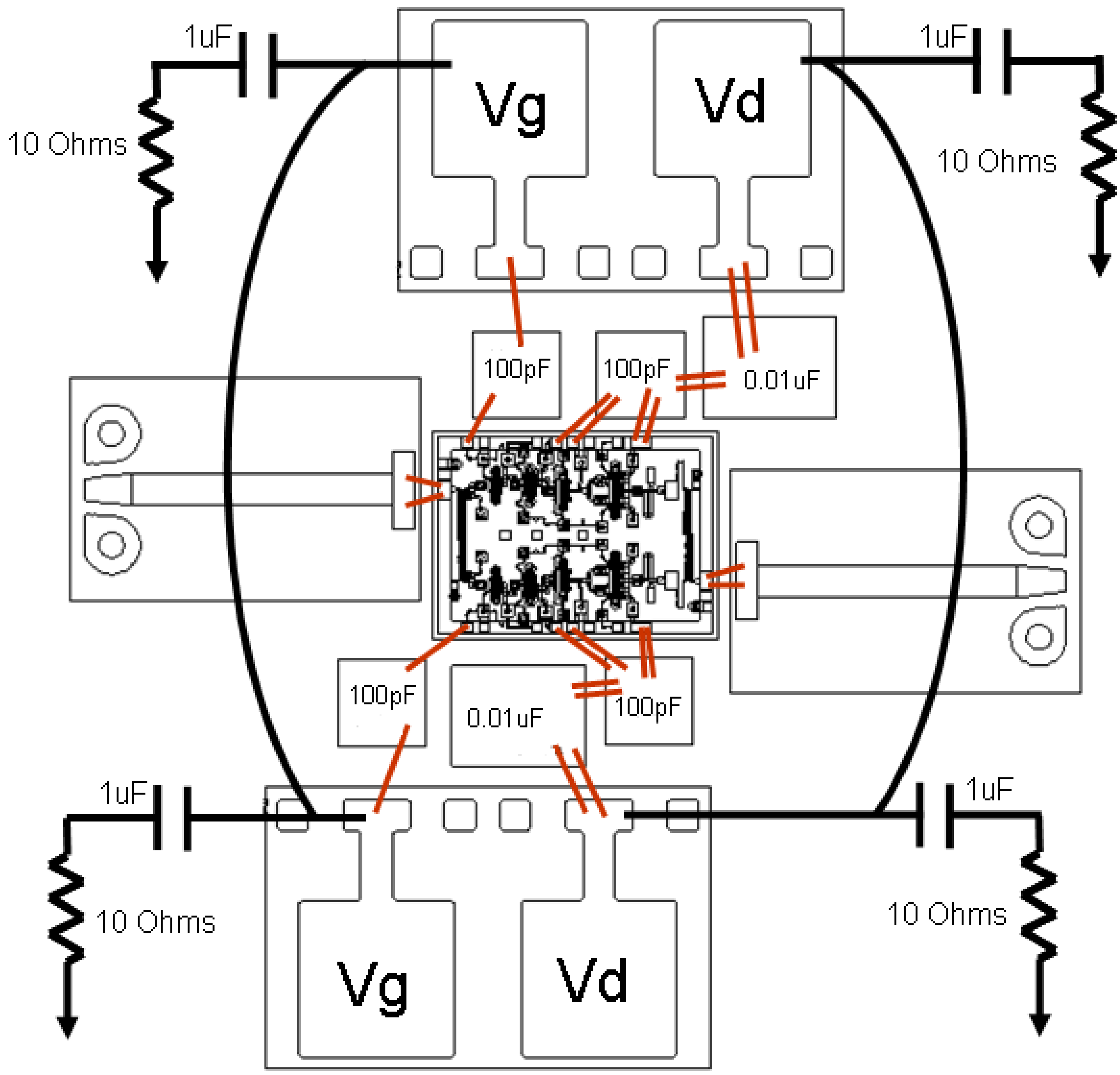


Units: millimeters
Thickness: 0.10
Die x, y size tolerance: +/ - 0.050
Chip edge to bond pad dimensions are shown to center of pad
Ground is backside of die

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



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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

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