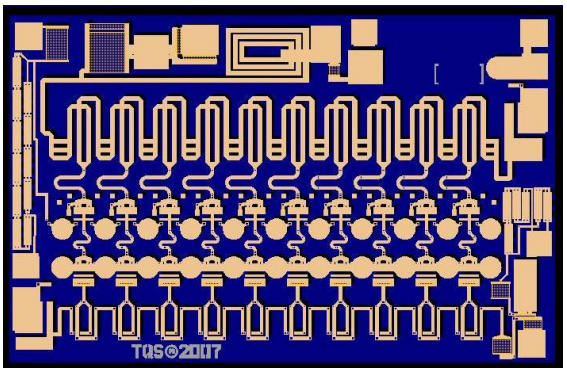
TriQuint SEMICONDUCTOR

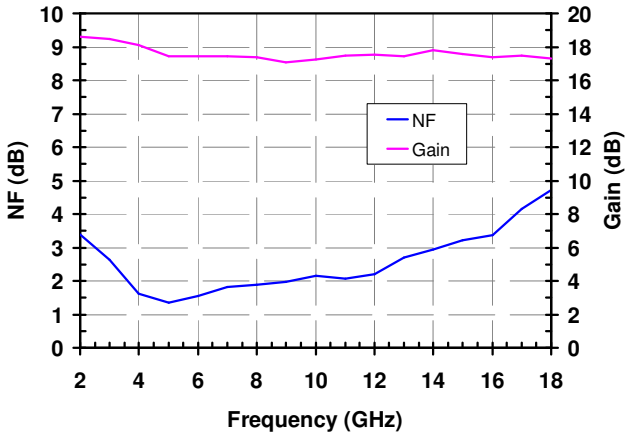
TGA2525

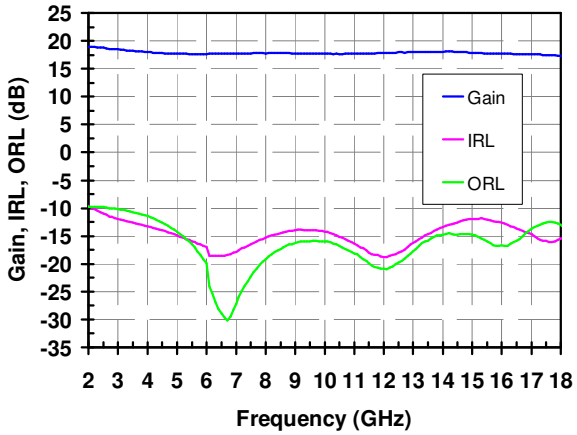
2-18 GHz Low Noise Amplifier with AGC



Measured Performance

Bias conditions: Vd = 5 V, Id = 75 mA, Vg1 = -0.6 V, Vg2 = +1.3 V Typical





Key Features

- Frequency Range: 2 - 18 GHz
- Midband NF: 2 dB
- Gain: 17 dB
- >30 dB adjustable gain with Vg2
- TOI: 29 dBm Typical
- 22 dBm Nominal Psat, 18 dBm Nominal P1dB
- ESD Protection circuitry on Vg1 & Vg2
- Bias: Vd = 5 V, Id = 75 mA, Vg1 = -0.6 V, Vg2 = +1.3 V, Typical
- Technology: 3MI 0.15 um Power pHEMT
- Chip Dimensions: 2.09 x 1.35 x 0.1 mm

Primary Applications

- Wideband Gain Block / LNA
- X-Ku Point to Point Radio
- Electronic Warfare Applications

Product Description

The TriQuint TGA2525 is a compact LNA Gain Block MMIC with adjustable gain control (AGC). The LNA operates from 2-18 GHz and is designed using TriQuint's proven standard 0.15 um Power pHEMT production process.

The TGA2525 provides a nominal 18 dBm of output power at 1 dB gain compression with a small signal gain of 17 dB. Greater than 30 dB adjustable gain can be achieved using Vg2 pin. Typical noise figure is 2 dB at 8 GHz. Special circuitry on both Vg1 and Vg2 pins provides ESD protection.

The TGA2525 is suitable for a variety of wideband systems such as point to point radios, radar warning receivers and electronic counter measures.

The TGA2525 is 100% DC and RF tested on-wafer to ensure performance compliance. The TGA2525 has a protective surface passivation layer providing environmental robustness.

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

Datasheet subject to change without notice.

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Table I
Absolute Maximum Ratings 1/

Symbol	Parameter	Value	Notes
Vd-Vg	Drain to Gate Voltage	10 V	
Vd	Drain Voltage	7 V	2/
Vg1 Vg2	Gate #1 Voltage Range Gate #2 Voltage Range	-2 to 0 V -2 to +3 V	
Id	Drain Current	144 mA	2/
Ig1 Ig2	Gate #1 Current Range Gate #2 Current Range	-24 to 24 mA -24 to 24 mA	3/
Pin	Input Continuous Wave Power	22 dBm	2/

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.

3/ ESD protection diodes on both Vg1 and Vg2 will conduct current for voltages approaching turn-on voltages. Diode turn-on voltage levels will decrease with decreasing temperature.

Table II
Recommended Operating Conditions

Symbol	Parameter 1/	Value
Vd	Drain Voltage	5 V
Id	Drain Current	75 mA
Id_Drive	Drain Current under RF Drive	130 mA
Vg1 Vg2	Gate #1 Voltage Gate #2 Voltage	-0.6 V 1.3 V

1/ See assembly diagram for bias instructions.

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Table III
RF Characterization Table

Bias: Vd = 5 V, Id = 75 mA, Vg1 = -0.6 V, Vg2 = +1.3 V typical

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	NOMINAL	MAX	UNITS
Gain	Small Signal Gain	f = 2 -14 GHz f = 14 - 18 GHz	14 14	17 17	- -	dB
IRL	Input Return Loss	f = 2 GHz f = 3 - 14 GHz f = 14 - 18 GHz	8.5 10 10	15 15 12	- - -	dB
ORL	Output Return Loss	f = 2 - 3 GHz f = 4 - 18 GHz	9 10	15 15	- -	dB
Psat	Saturated Output Power	f = 2 - 14 GHz f = 14 – 18 GHz	- -	22 20	-	dBm
P1dB	Output Power @ 1dB Compression	f = 2 GHz f = 4, 8 GHz f = 10, 14 GHz f = 18 GHz	14 15 13 11	18 17 17 15	- - - -	dBm
TOI	Output TOI	f = 2 - 14 GHz f = 14 – 18 GHz	- -	29 25	- -	dBm
NF	Noise Figure	f = 2 - 14 GHz f = 14 - 18 GHz	- -	2 4	4 6	dB
S21/T	S21 Temperature Dependence	f = 2 - 18 GHz	-	-0.008	-	dB / ℃

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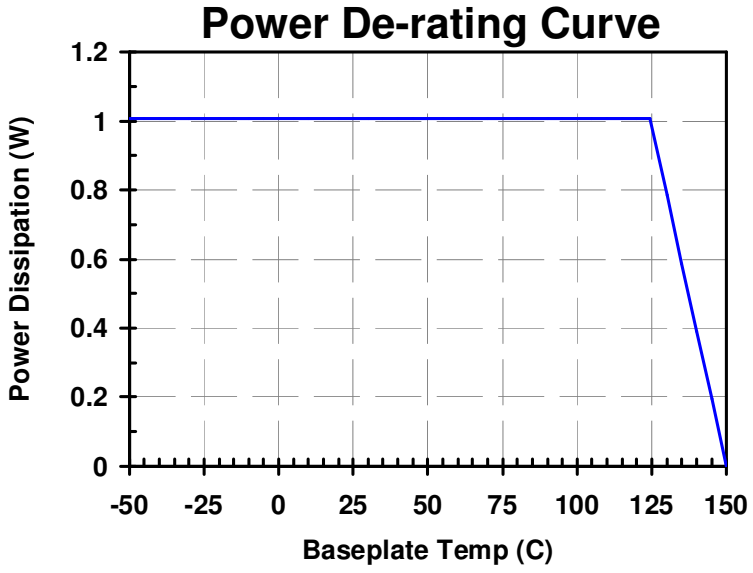
Table IV
Power Dissipation and Thermal Properties

Parameter	Test Conditions	Value	Notes
Maximum Power Dissipation	Tbaseplate = 70 ℃	Pd = 1.01 W Tchannel = 96 ℃ Tm = 9.7 E+8 Hrs	1/ 2/
Thermal Resistance, θjc	Vd = 5 V Id = 75 mA Pd = 0.375 W	θjc = 41.4 (℃/W) Tchannel = 86 ℃ Tm = 4.3 E+9 Hrs	
Thermal Resistance, θjc Under RF Drive	Vd = 5 V Id = 120 mA Pout = 22 dBm Pd = 0.45 W	θjc = 41.4 (℃/W) Tchannel = 89 ℃ Tm = 2.7 E+9 Hrs	
Mounting Temperature	30 Seconds	320 ℃	
Storage Temperature		-65 to 150 ℃	

1/ For a median life of 1E+6 hours, Power Dissipation is limited to

$$Pd(max) = (150\ ^\circ C - Tbase\ ^\circ C)/\theta jc.$$

2/ Channel operating temperature will directly affect the device median time to failure (MTTF). For maximum life, it is recommended that channel temperatures be maintained at the lowest possible levels.



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Measured Data

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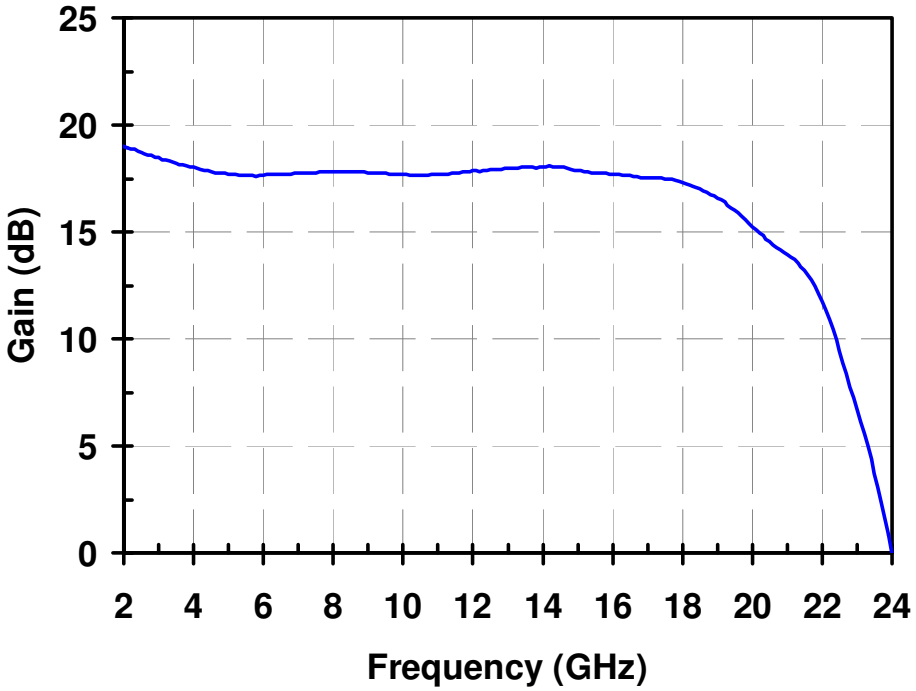

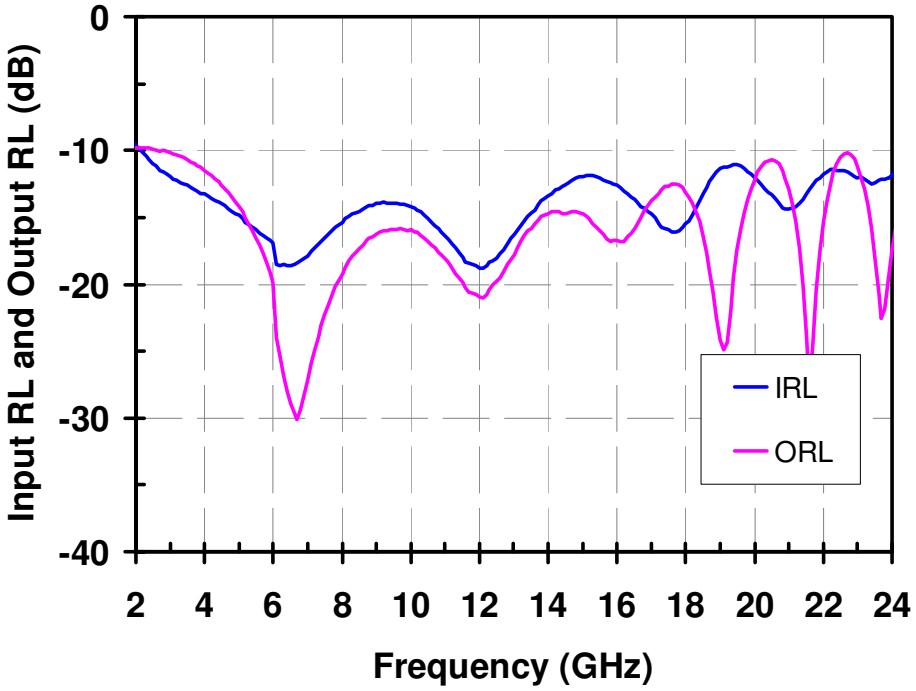

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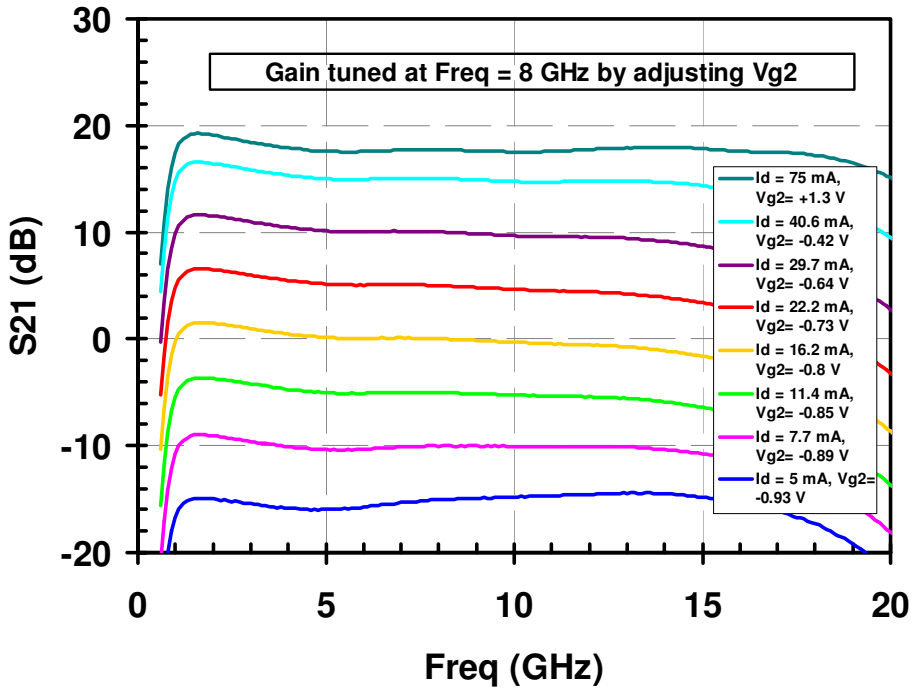

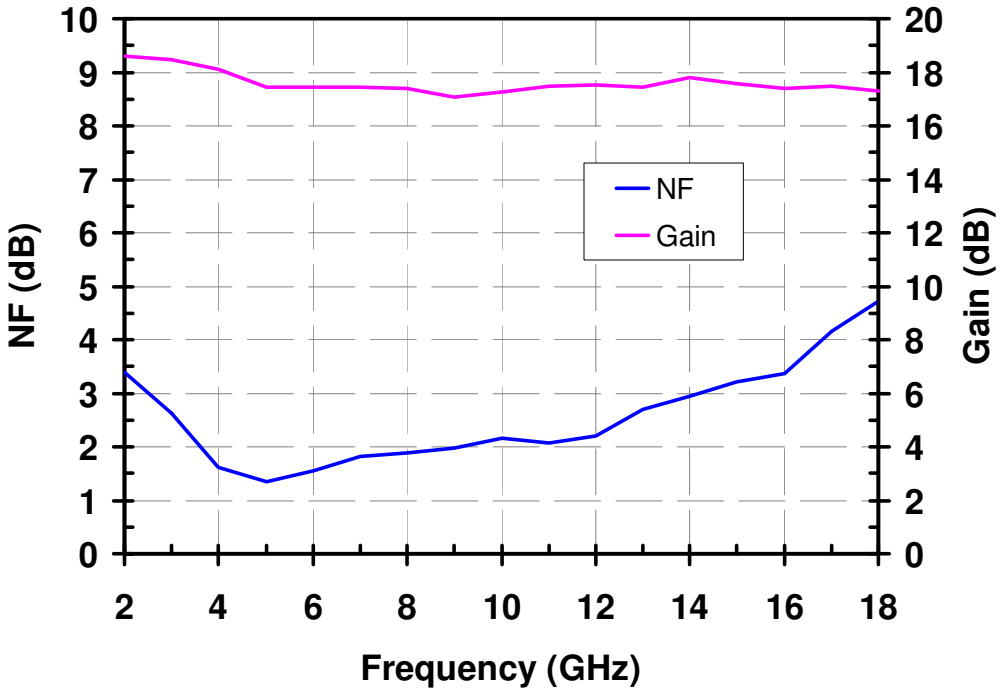

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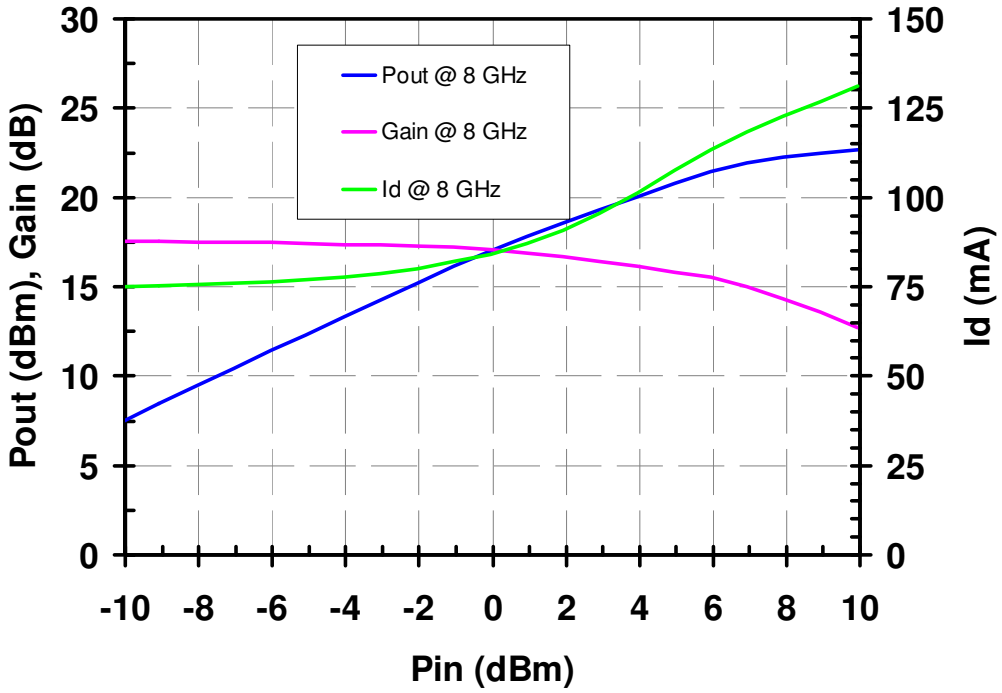

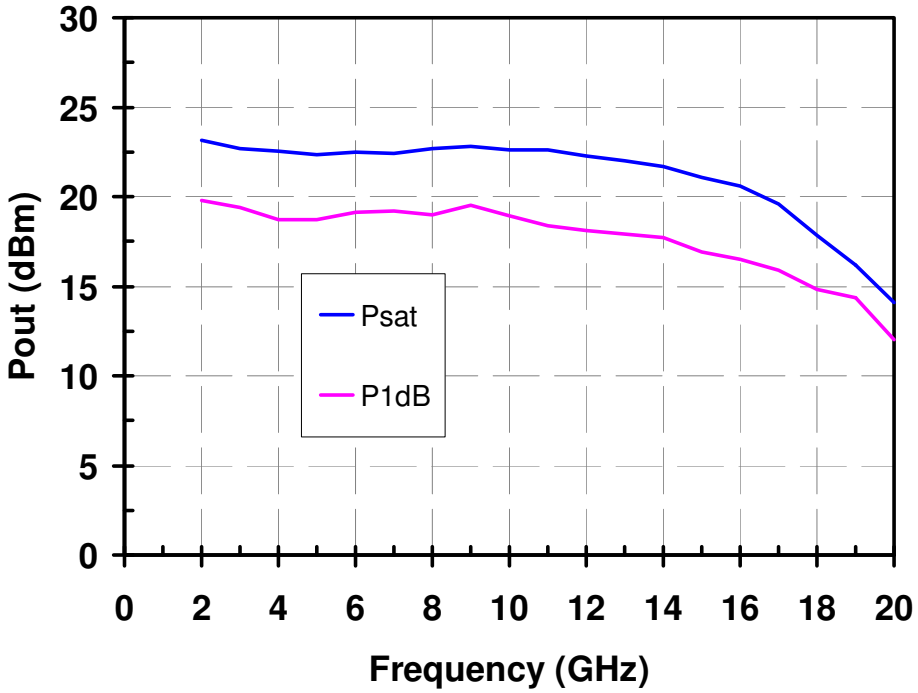

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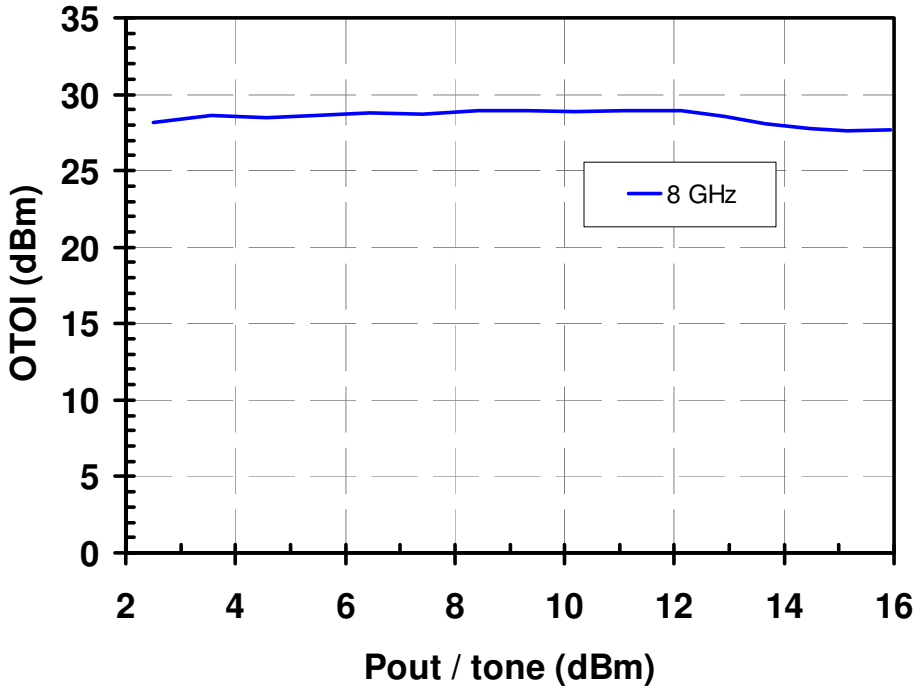

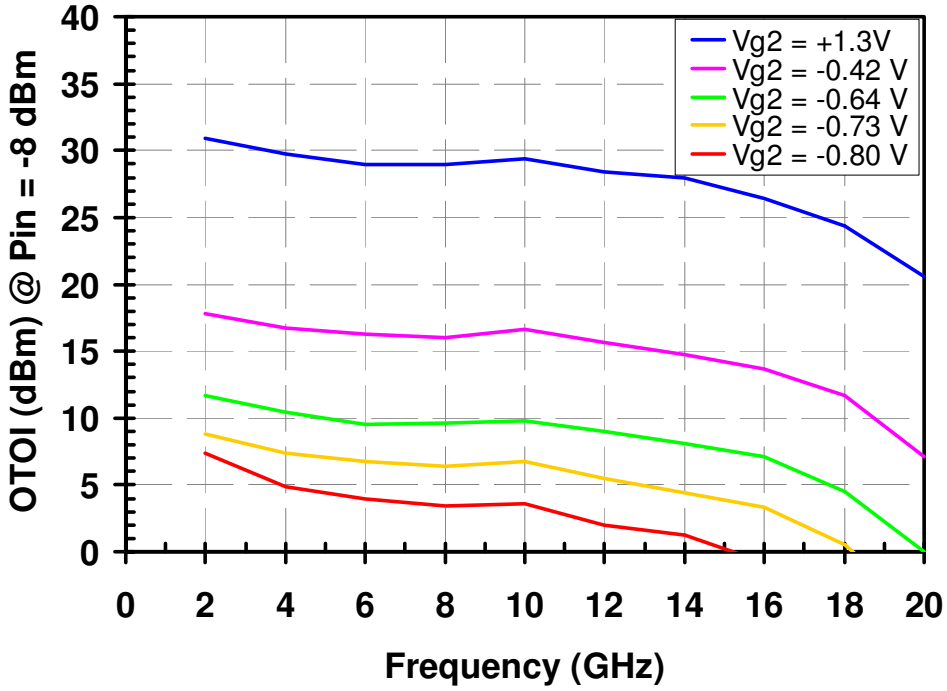

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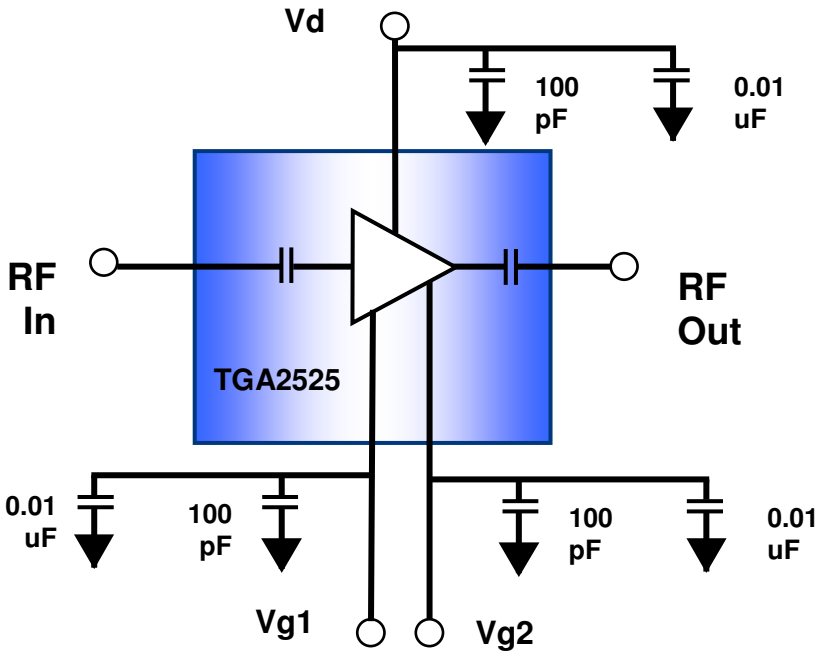
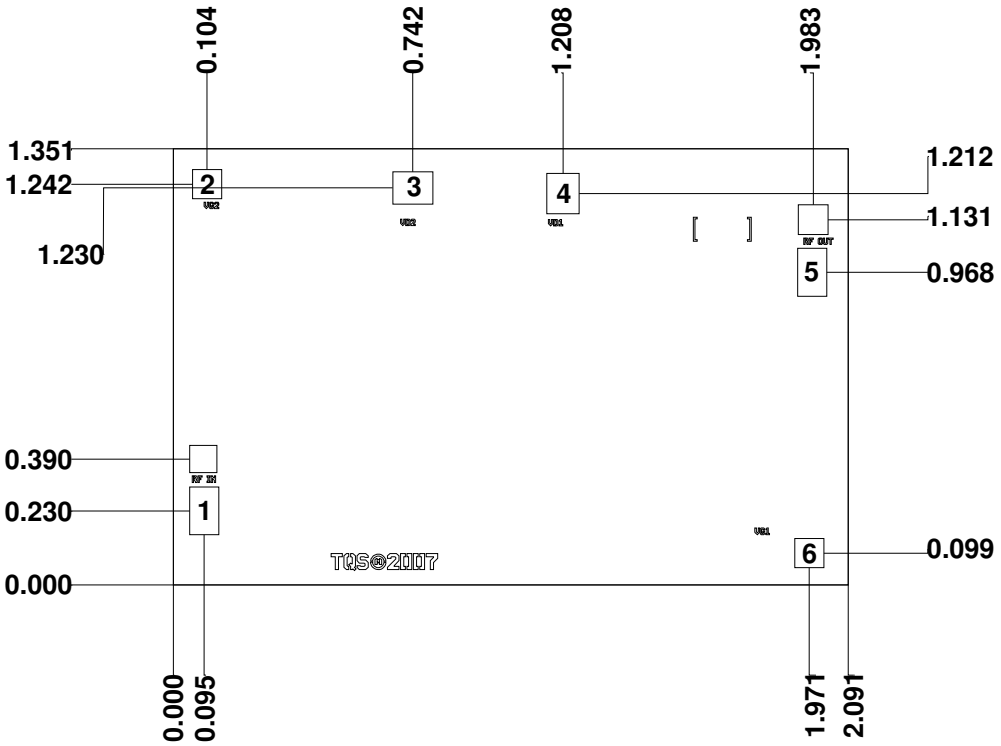
Electrical Schematic



Bias Procedures

Bias-up Procedure	**Bias-down Procedure**
Vg1 set to -1.5 V	Reduce Vg2 to +1 V
Vd set to +5 V	Turn off RF supply
Vg2 set to +1 V	Reduce Vg1 to -1.5V. Ensure Id ~ 0 mA
Adjust Vg1 more positive until Id is 75 mA. This will be ~ Vg1 = -0.6 V	Vg2 to 0 V
Apply RF signal to input	Turn Vd to 0 V
Adjust Vg2 to obtain desired gain.	Turn Vg1 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	0.090 x 0.148	Bond Pad #4	Vd1	0.100 x 0.125
Bond Pad #2	Vg2	0.090 x 0.090	Bond Pad #5	RF Out	0.090 x 0.148
Bond Pad #3	Vd2 (Not used)	0.125 x 0.100	Bond Pad #6	Vg1	0.090 x 0.090

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

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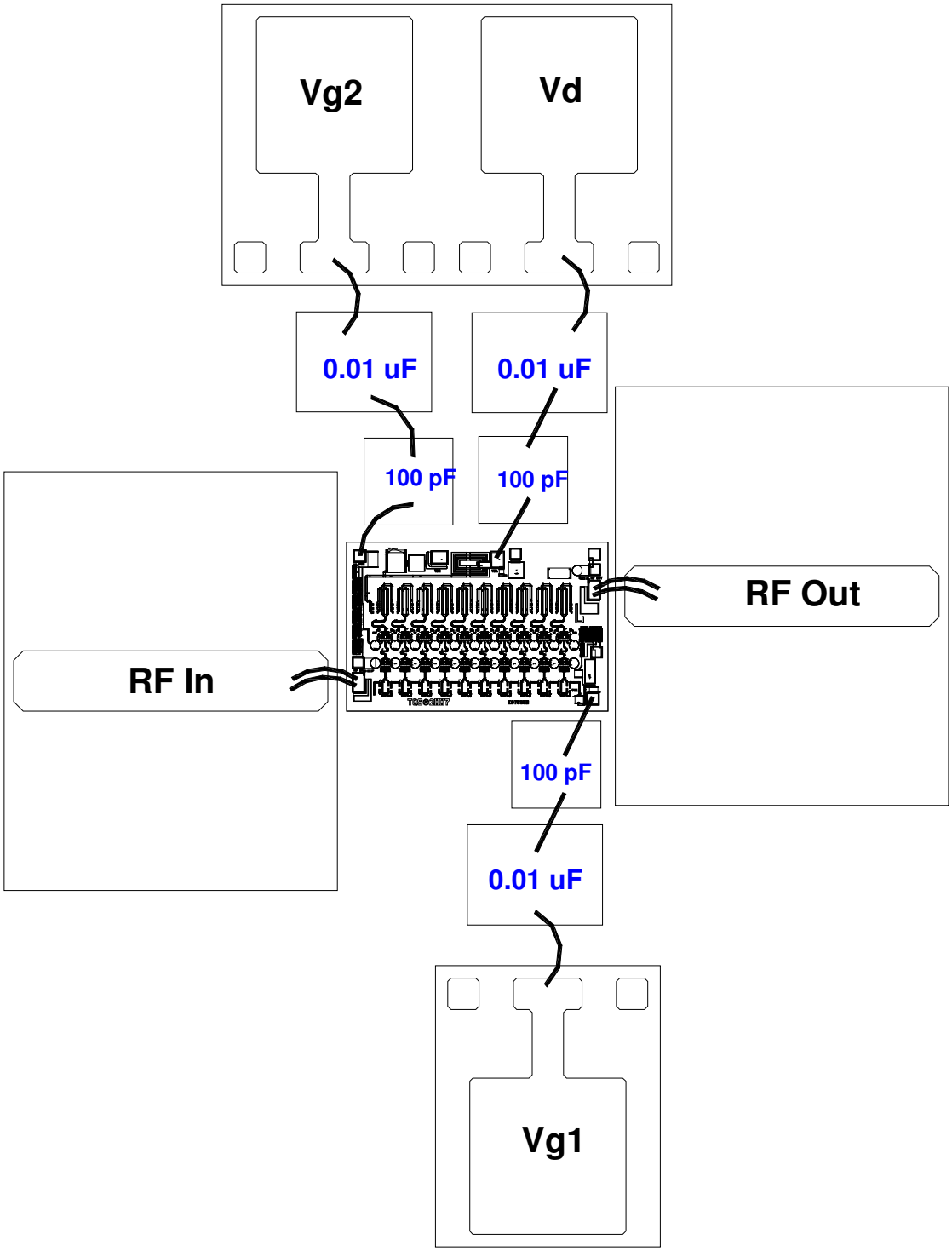
Recommended Assembly Diagram



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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
TGA2525	EAR99	GaAs MMIC Die

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