

### General Description

The Qorvo TGA2525 is a compact LNA Gain Block MMIC with adjustable gain control (AGC). The LNA operates from 2-18 GHz and is designed using Qorvo'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.

### Applications

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

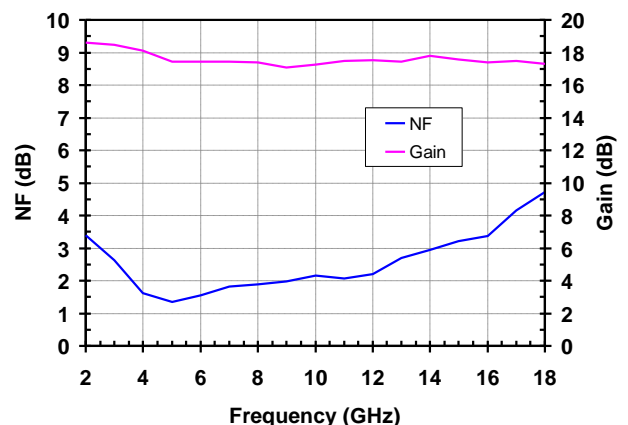
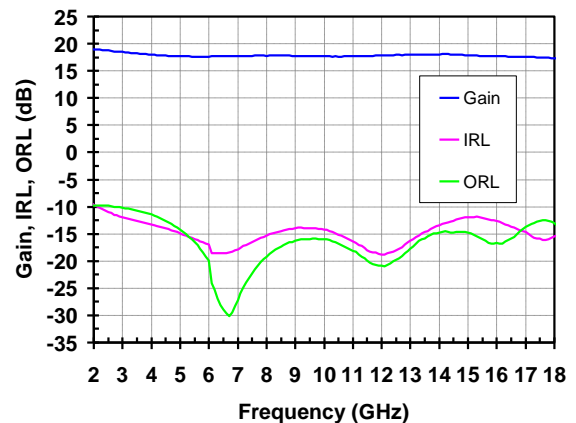
### Product Features

- 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 and Vg2
- Bias: Vd = 5 V, Id = 75 mA, Vg1 = -0.6 V, Vg2 = +1.3 V, Typical
- Technology: 3 MI 0.15 um Power pHEMT
- Chip Dimensions: 2.09 x 1.35 x 0.100 mm



### Measured Performance

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



### Ordering Information

Part	Description
TGA2525	GaAs MMIC Die, Gel Pack, Qty 100
1075728	TGA2525 Evaluation Board, Qty 1

### Absolute Maximum Ratings<sup>1/</sup>

Symbol	Parameter	Value	Notes
$V_D-V_G$	Drain to Gate Voltage	10 V	
$V_D$	Drain Voltage	7 V	<u>2/</u>
$V_{G1}$	Gate # 1 Voltage Range	-2 to 0 V	
$V_{G2}$	Gate # 2 Voltage Range	-2 to +3 V	
$I_D$	Drain Current	144 mA	<u>2/</u>
$I_{G1}$	Gate # 1 Current Range	-24 to 24 mA	<u>3/</u>
$I_{G2}$	Gate # 2 Current Range	-24 to 24 mA	<u>3/</u>
$P_{IN}$	Input Continuous Wave Power	22 dBm	<u>2/</u>
$T_{channel}$	Channel Temperature	200 °C	
$T_{storage}$	Storage Temperature	-65 to 150 °C	

- Note:
- 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  $V_D$ ,  $V_{G1}$  and  $V_{G2}$  will conduct current for voltages approaching turn-on voltages. Diode turn-on voltage levels will decrease with decreasing temperature.

### Recommended Operating Conditions

Symbol	Parameter <sup>1/</sup>	Value
V <sub>D</sub>	Drain Voltage	5 V
I <sub>D</sub>	Drain Current	75 mA
I <sub>D_Drive</sub>	Drain Current under RF Drive	130 mA
V <sub>G1</sub>	Gate # 1 Voltage	-0.6 V
V <sub>G2</sub>	Gate # 2 Voltage	1.3 V

Note:

<sup>1/</sup> See assembly diagram for bias instructions.

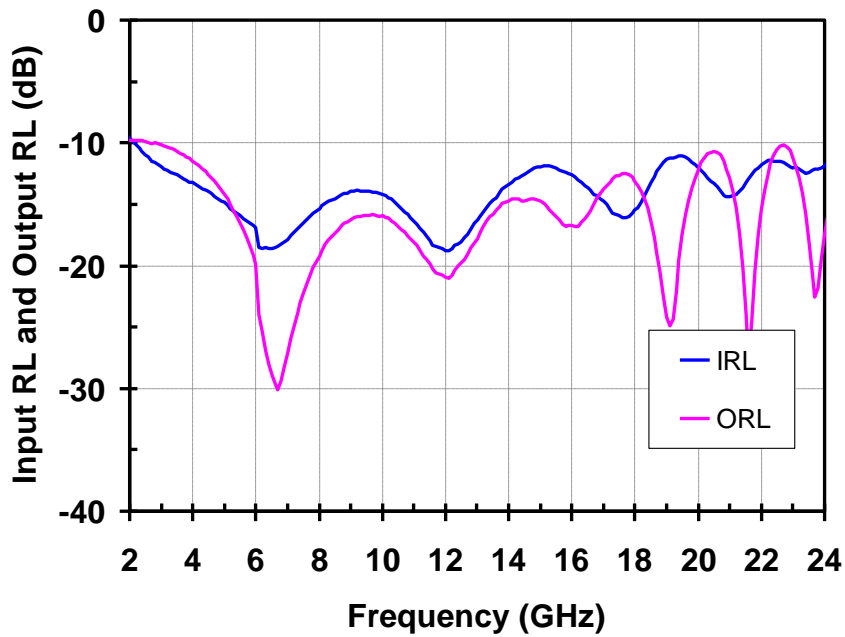
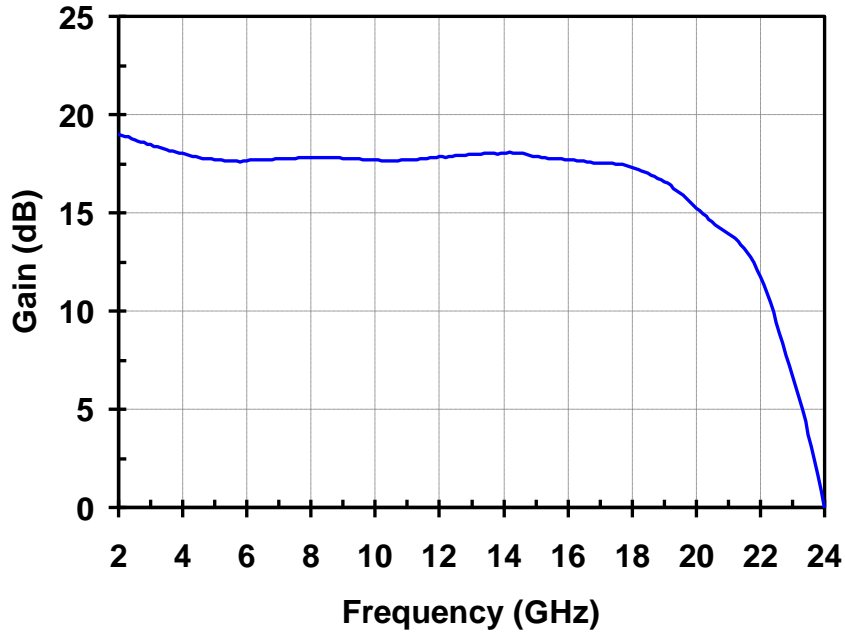
### RF Characterization Table

Bias: V<sub>D</sub> = 5 V, I<sub>D</sub> = 75 mA, V<sub>G1</sub> = -0.6 V, V<sub>G2</sub> = +1.3 V, typical. Ambient temperature: 25 °C  
 Data de-embedded to the end of RF feeds, data include bond wire effects

Symbol	Parameter	Test Conditions	Min	Normal	Max	Units
Gain	Small Signal Gain	f = 2–18 GHz	14	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 = 2–4 GHz f = 5–18 GHz	9 10	11 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 / °C

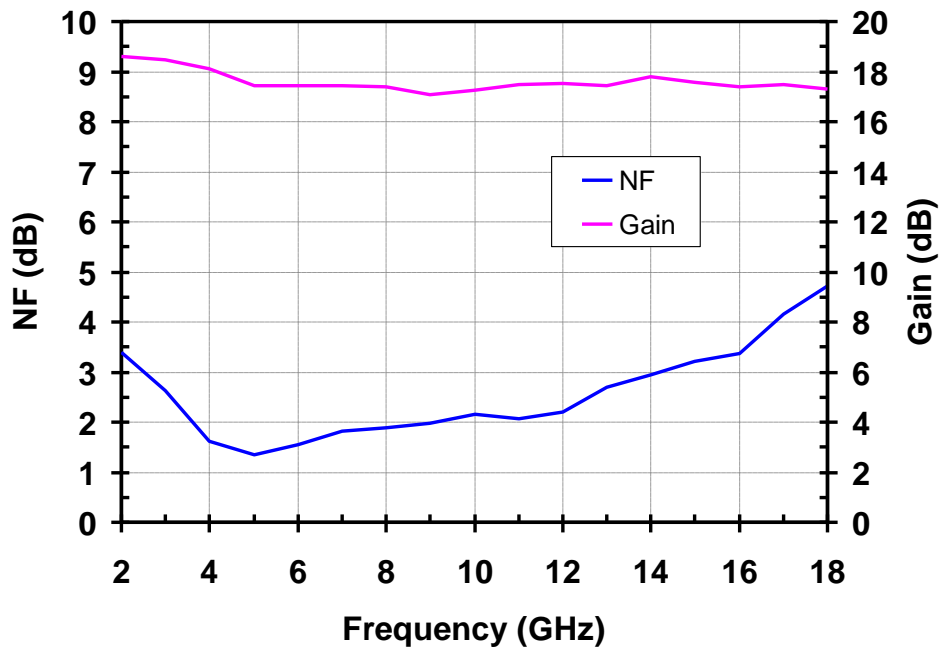
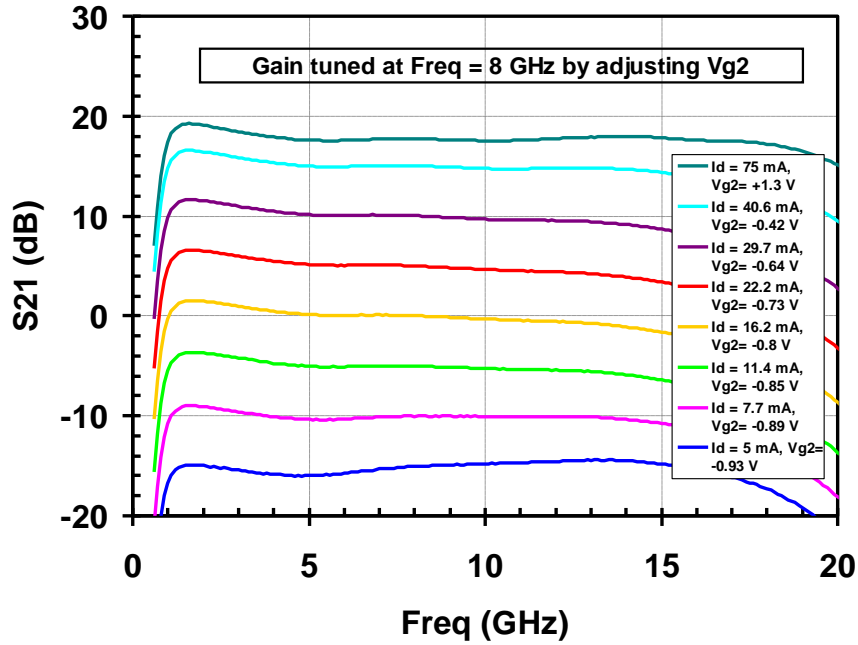
Measured Data

Bias conditions:  $V_D = 5\text{ V}$ ,  $I_D = 75\text{ mA}$ ,  $V_{G1} = -0.6\text{ V}$ ,  $V_{G2} = +1.3\text{ V}$  Typical,  $25\text{ }^\circ\text{C}$



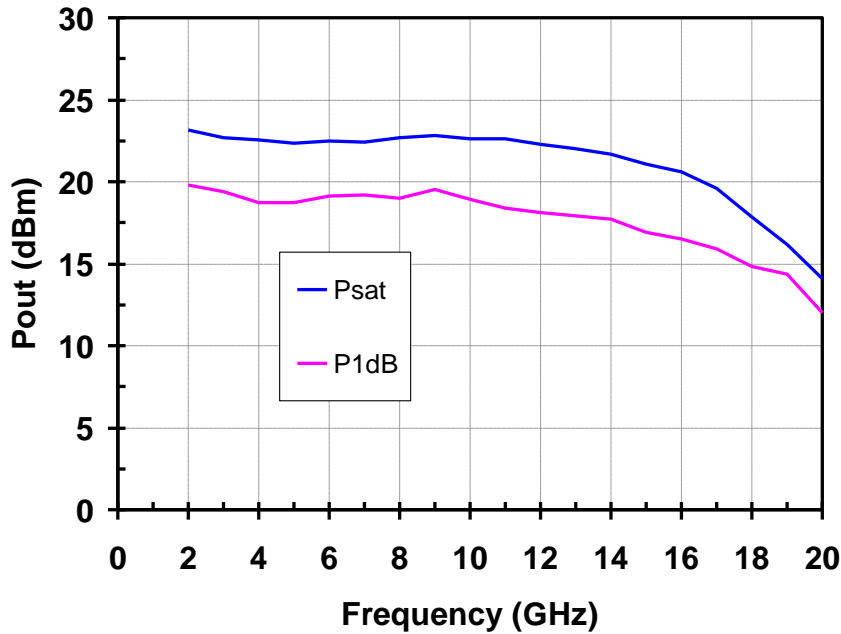
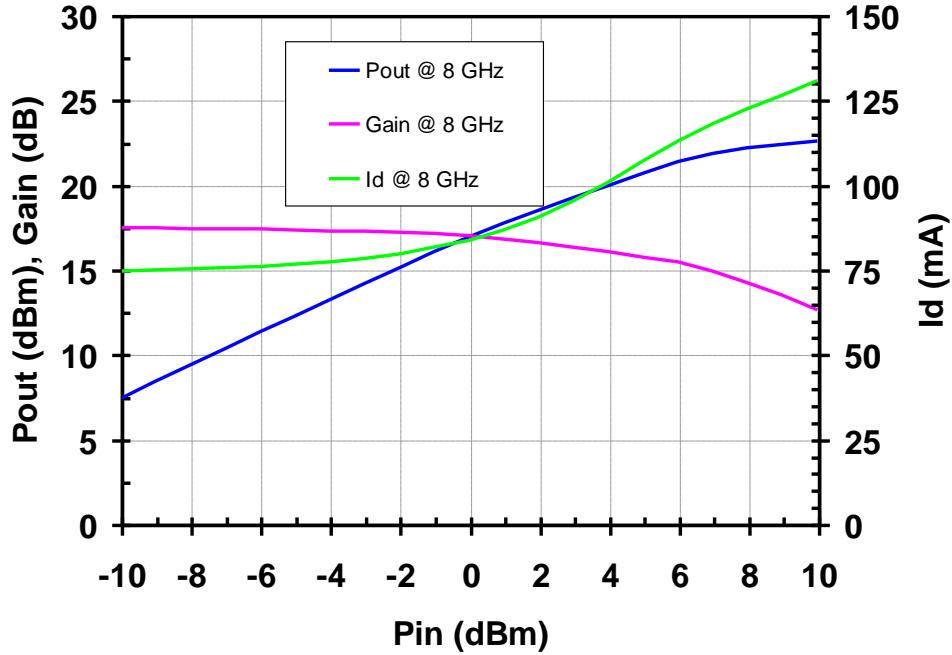
Measured Data

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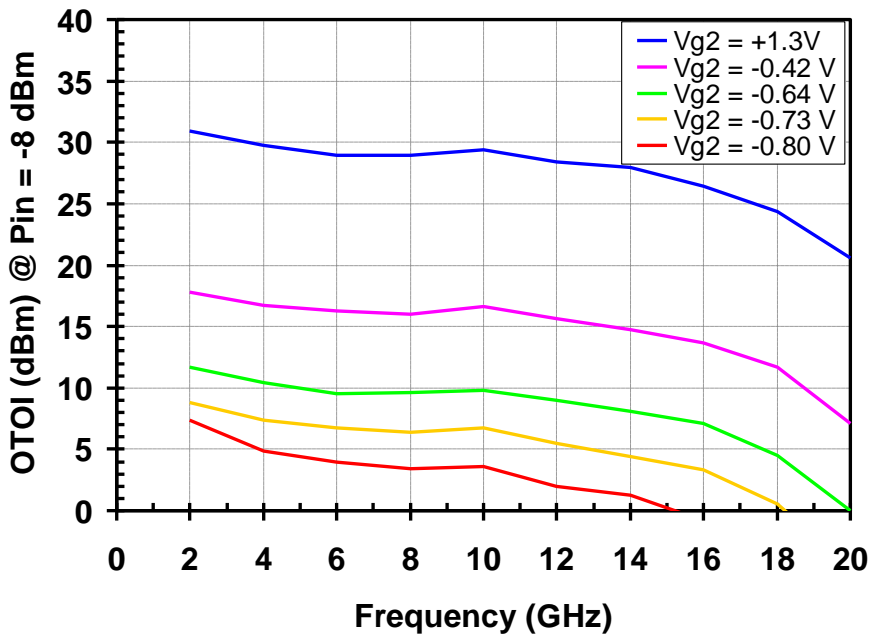
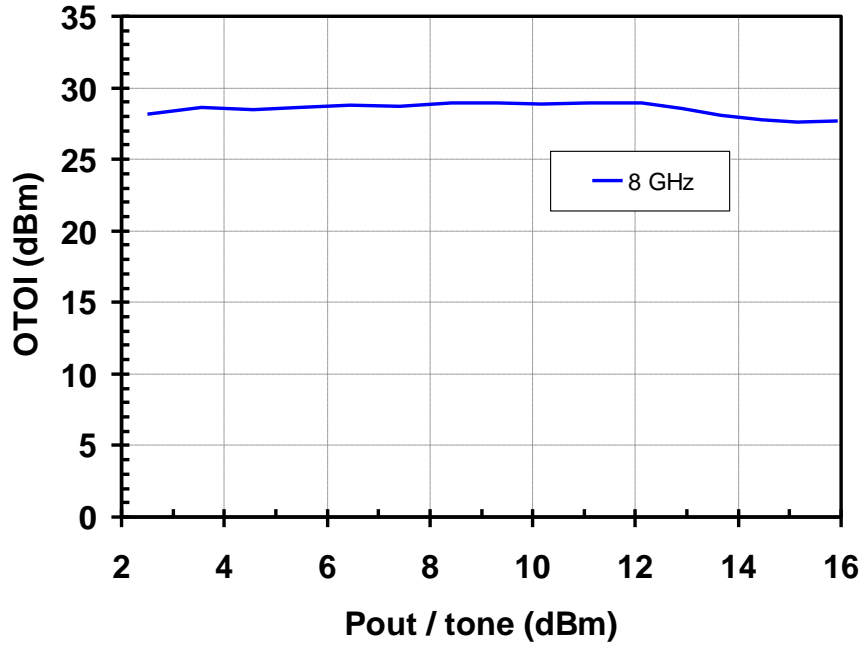
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Measured Data

Bias conditions:  $V_D = 5\text{ V}$ ,  $I_D = 75\text{ mA}$ ,  $V_{G1} = -0.6\text{ V}$ ,  $V_{G2} = +1.3\text{ V}$  Typical,  $25\text{ }^\circ\text{C}$

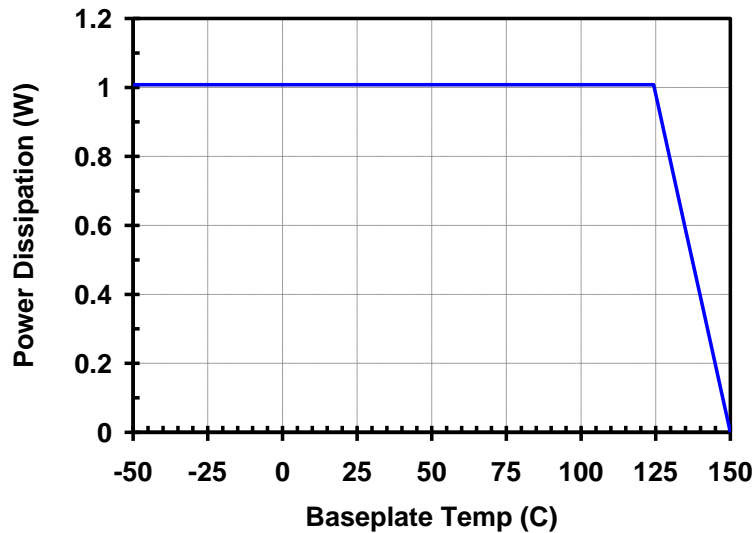


### Power Dissipation and Thermal Properties

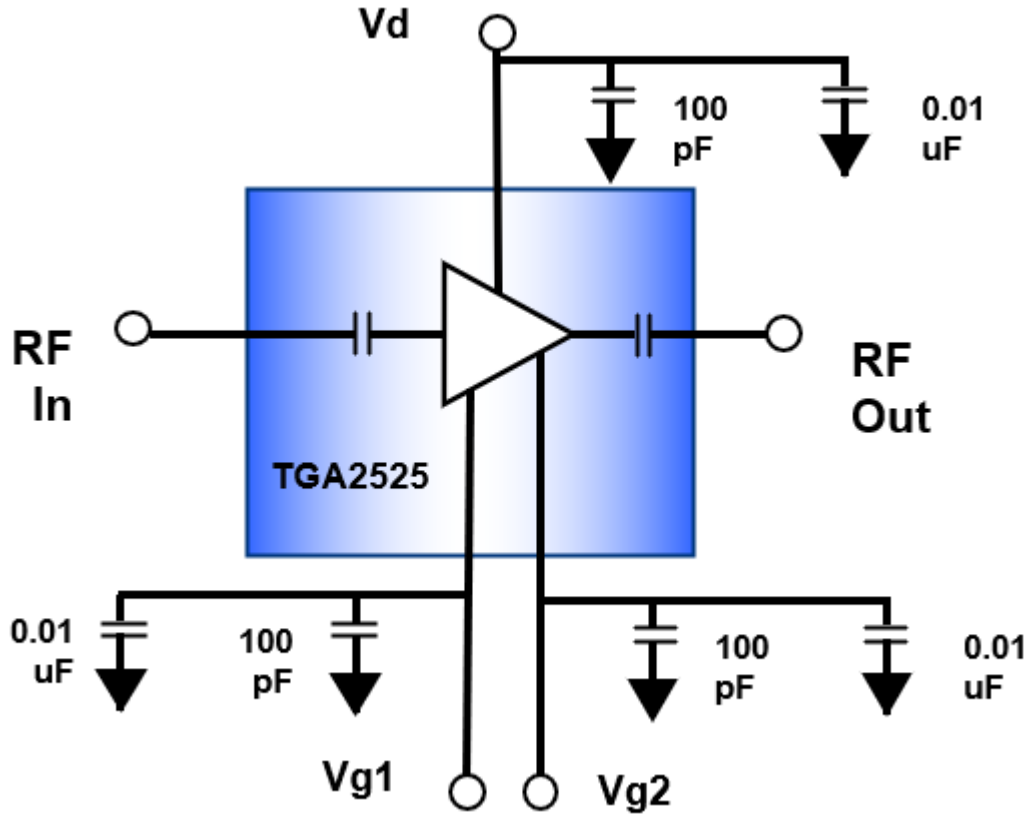
Parameter	Test Conditions	Value	Notes
Maximum Power Dissipation	Tbase = 70 °C	Pd = 1.01 W Tchannel = 96 °C Tm = 9.7 E+8 Hrs	1/ 2/
Thermal Resistance, $\theta_{jc}$	Vd = 5 V Id = 75 mA Pd = 0.375 W	$\theta_{jc}$ = 41.4 (°C/W) Tchannel = 86 °C Tm = 4.3 E+9 Hrs	
Thermal Resistance, $\theta_{jc}$ Under RF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

- 1/ For a median life of 1E+6 hours, Power Dissipation is limited to  $Pd(max) = (150\text{ °C} - Tbase\text{ °C})/\theta_{jc}$ .
- 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.

### Power De-rating Curve



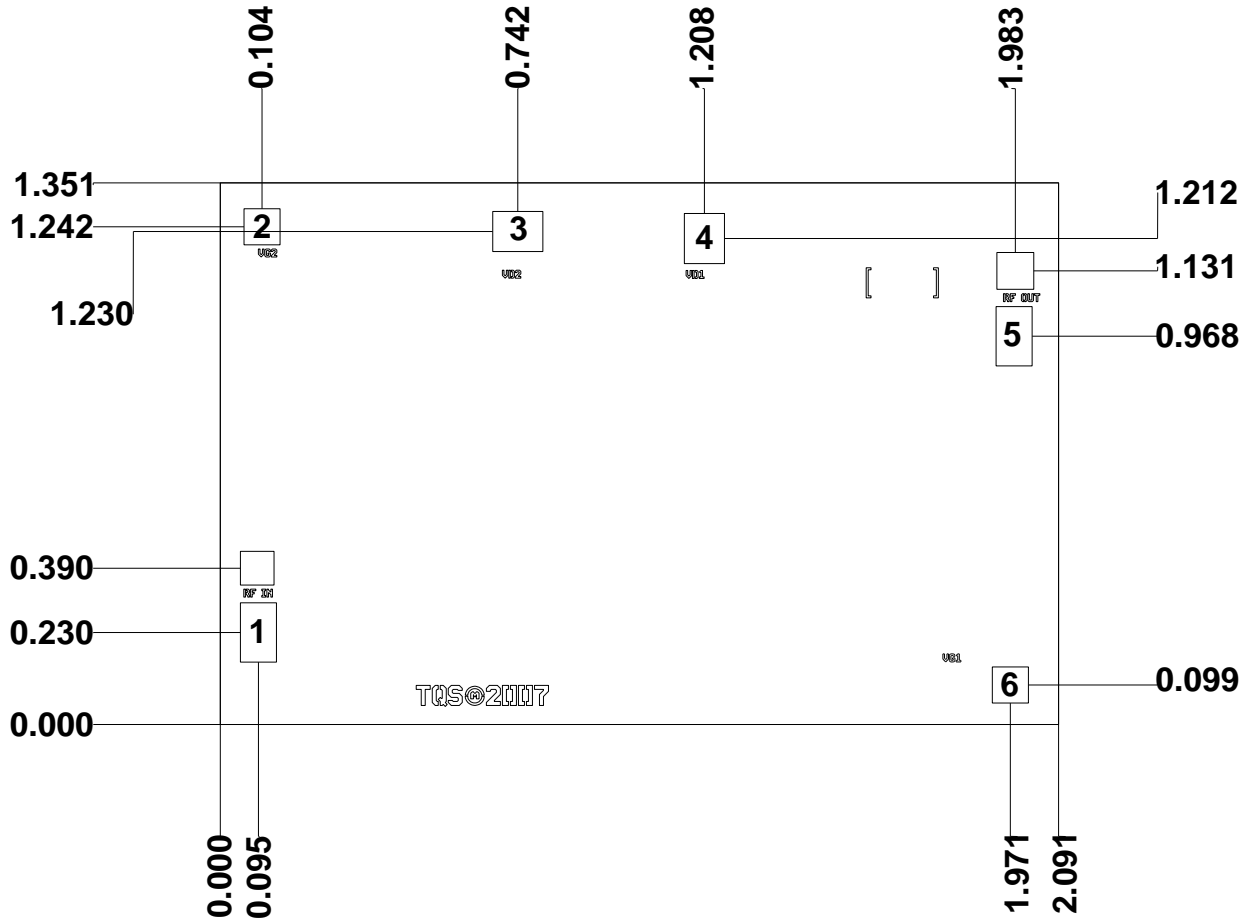
Electrical Schematic



Bias Procedures

Bias-up Procedure	Bias-down Procedure
V <sub>G1</sub> set to -1.5 V	Turn off RF signal
V <sub>D</sub> set to +5 V	Reduce V <sub>G1</sub> to -1.5 V. Ensure I <sub>d</sub> ~ 0 mA
V <sub>G2</sub> set to +1.3 V	Turn V <sub>G2</sub> to 0 V
Adjust V <sub>G1</sub> more positive until I <sub>d</sub> is 75 mA. This will be ~ V <sub>G1</sub> = -0.6 V	Turn V <sub>D</sub> to 0 V
Apply RF signal	Turn V <sub>G1</sub> to 0 V
	Turn off all power supplies

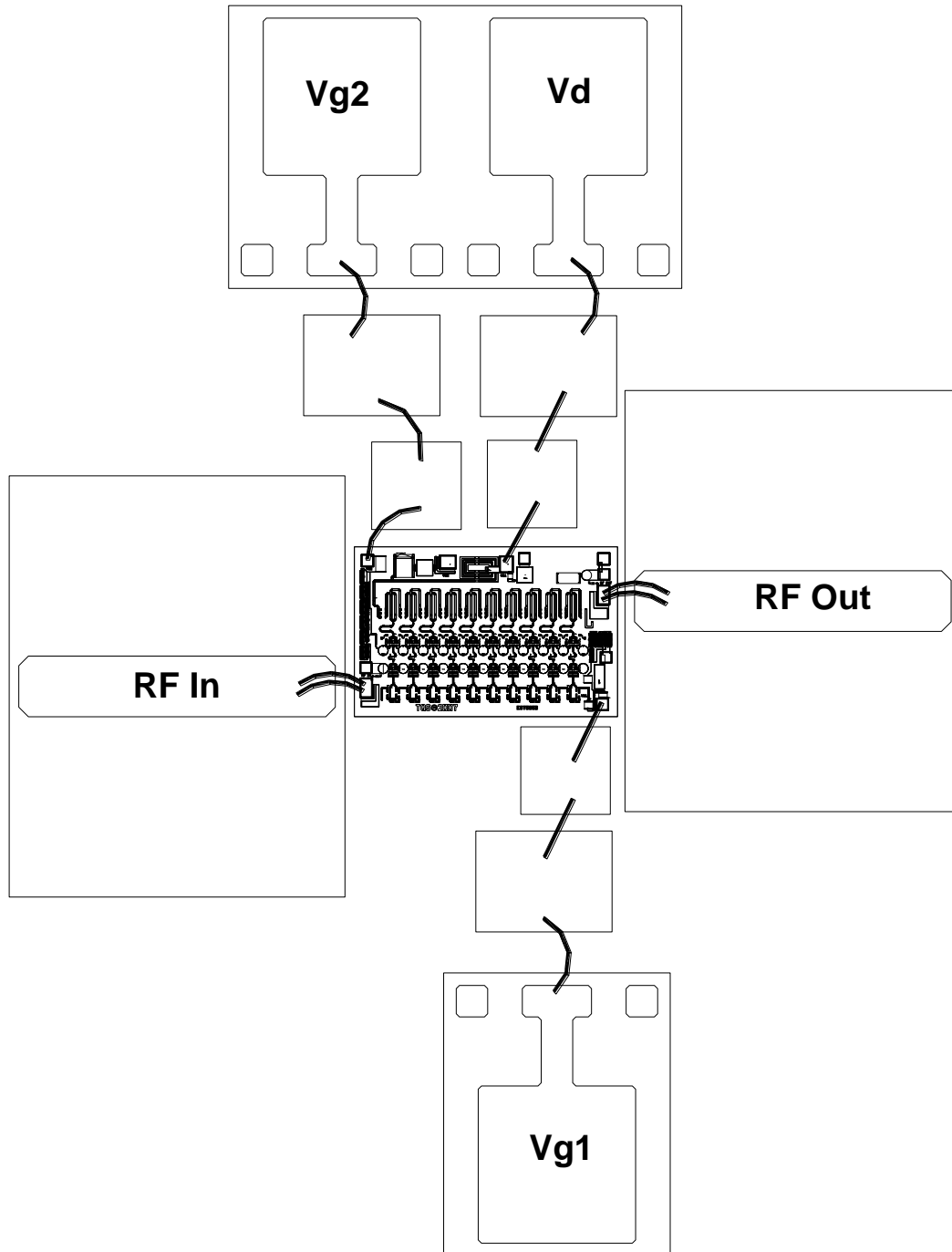
Mechanical Drawing and Bond Pad Description



Unit: millimeters. Die 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

Pad No.	Label	Pad Size (mm)	Description
1	RF Input	0.090 x 0.148	RF Input Port, matched to 50 ohms, DC blocked
2	VG2	0.090 x 0.090	Gate Voltage Control
3	VD2	0.125 x 0.100	Drain voltage termination, no connection required
4	VD1	0.100 x 0.125	Drain Voltage
5	RF output	0.090 x 0.148	RF Output Port, matched to 50 ohms, DC blocked
6	VG1	0.090 x 0.090	Gate Voltage Control

Recommended Assembly Diagram



### Assembly Notes

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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 ultrasonic are critical parameters.
- Aluminum wire should not be used.
- Devices with small pad sizes should be bonded with 0.0007-inch wire.

### Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	TBD	ESDA / JEDEC JS-001-2017
ESD – Charged Device Model (CDM)	TBD	ESDA / JEDEC JS-002-2014
MSL – Convection Reflow 260 °C	N / A	



Caution!  
ESD-Sensitive Device

### RoHS Compliance

This part is compliant with 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 (C<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- SVHC Free
- PFOS Free

### Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

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Web: [www.qorvo.com](http://www.qorvo.com)

Email: [customer.support@qorvo.com](mailto:customer.support@qorvo.com)

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