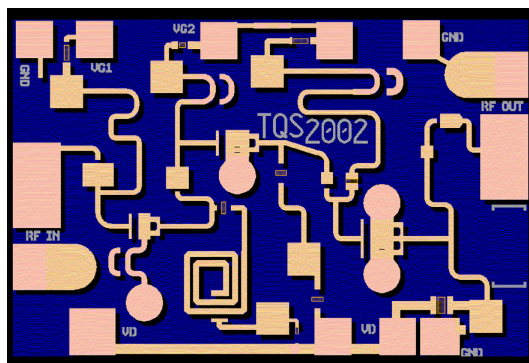


K Band Low Noise Amplifier

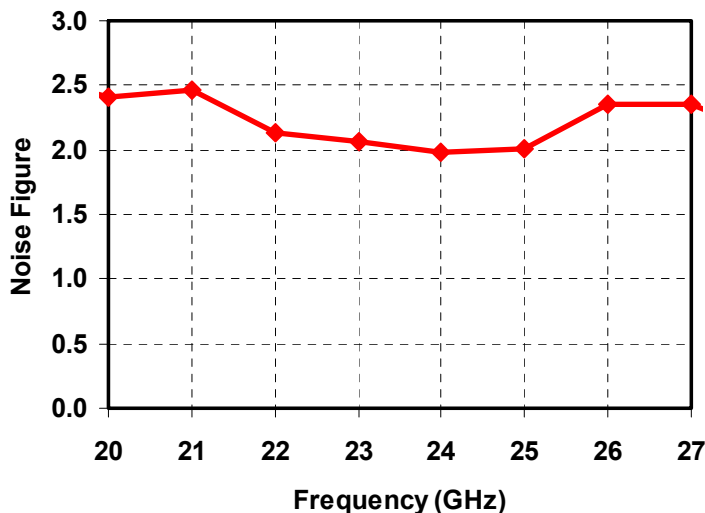
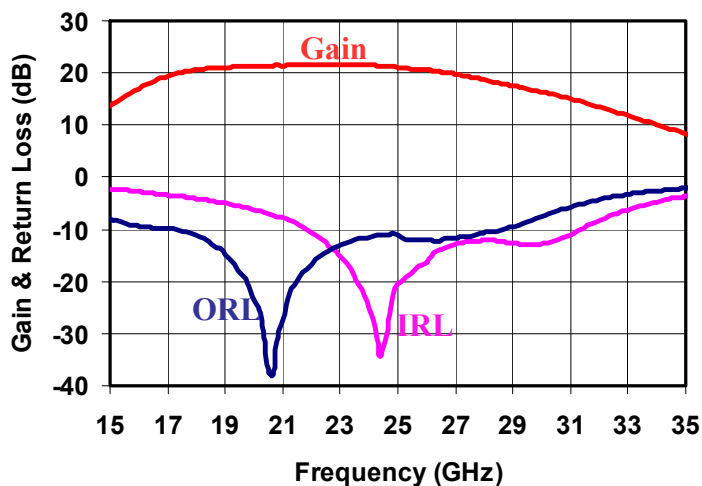


Key Features

- Typical Frequency Range: 20 - 27 GHz
- 21 dB Nominal Gain
- 2.2 dB Nominal Noise Figure
- 12 dBm Nominal P1dB
- Bias 3.5 V, 60 mA
- 0.15 μ m 3MI pHEMT Technology
- Chip Dimensions 1.2 x 0.8 x 0.1 mm
(0.047 x 0.031 x 0.004) in

Preliminary Measured Data

Bias Conditions: $V_d = 3.5$ V, $I_d = 60$ mA



Primary Applications

- Point-to-Point Radio
- Point-to-MultiPoint Radio
- LMDS

TABLE I
MAXIMUM RATINGS 1/

SYMBOL	PARAMETER	VALUE	NOTES
V _d	Drain Voltage	5 V	<u>2/</u>
V _g	Gate Voltage Range	-1 TO +0.5 V	
I _d	Drain Current	190 mA	<u>2/ 3/</u>
I _g	Gate Current	6 mA	<u>3/</u>
P _{IN}	Input Continuous Wave Power	12 dBm	
P _D	Power Dissipation	0.95 W	<u>2/ 4/</u>
T _{CH}	Operating Channel Temperature	200 °C	<u>5/ 6/</u>
	Mounting Temperature (30 Seconds)	320 °C	
T _{STG}	Storage Temperature	-65 to 150 °C	

- 1/ These ratings represent the maximum operable values for this device.
- 2/ Combinations of supply voltage, supply current, input power, and output power shall not exceed P_D.
- 3/ Total current for the entire MMIC.
- 4/ When operated at this bias condition with a base plate temperature of 70 °C, the median life is reduced to 1.9E3 hrs.
- 5/ Junction operating temperature will directly affect the device median time to failure (T_m). For maximum life, it is recommended that junction temperatures be maintained at the lowest possible levels.
- 6/ These ratings apply to each individual FET.

TABLE II
DC PROBE TESTS
(Ta = 25 °C Nominal)

SYMBOL	PARAMETER	MINIMUM	MAXIMUM	VALUE
V _{P3}	Pinch-off Voltage	-1.0	-0.1	V

Q3 is 300 um FET

TABLE III
ELECTRICAL CHARACTERISTICS
(Ta = 25 °C Nominal)

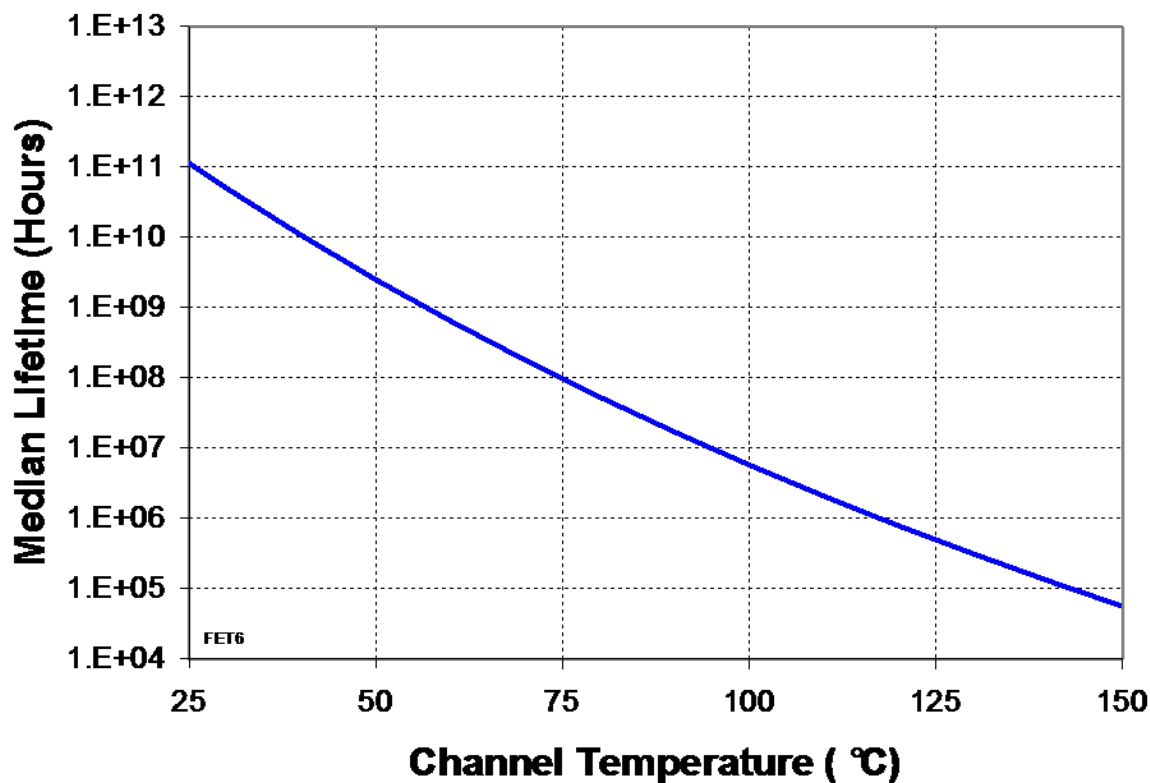
PARAMETER	TYPICAL	UNITS
Drain Voltage, Vd	3.5	V
Drain Current, Id	60	mA
Gate Voltage, Vg	-0.5 to 0	V
Small Signal Gain, S21	21	dB
Input Return Loss, S11	15	dB
Output Return Loss, S22	11	dB
Noise Figure, NF	2.2	dB
Output Power @ 1 dB Compression Gain, P1dB	12	dBm

TABLE IV
THERMAL INFORMATION

PARAMETER	TEST CONDITIONS	T _{CH} (°C)	θ _{JC} (°C/W)	T _m (HRS)
θ _{JC} Thermal Resistance (channel to Case)	V _d = 3.5 V I _d = 60 mA P _{diss} = 0.21 W	98	133	7.2E+6

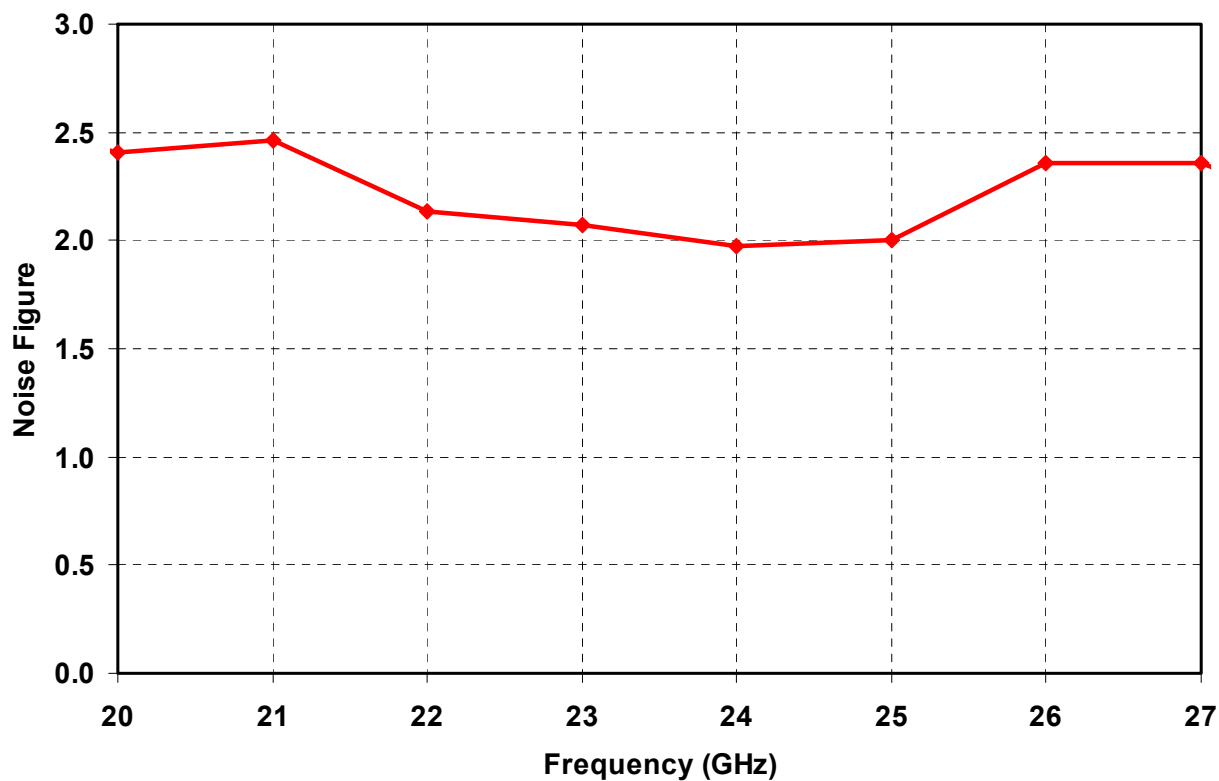
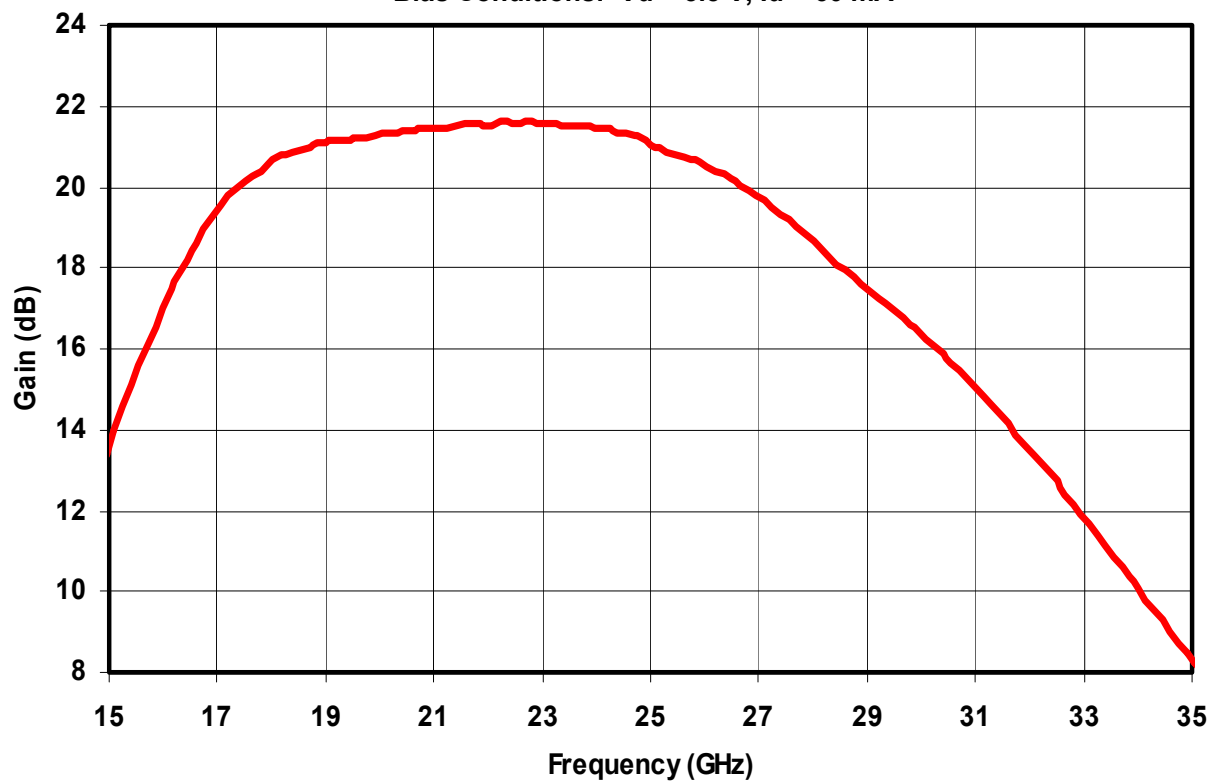
Note: Assumes eutectic attach using 1.5 mil 80/20 AuSn mounted to a 20 mil CuMo Carrier at 70°C baseplate temperature. Worst case condition with no RF applied, 100% of DC power is dissipated.

Median Lifetime (T_m) vs. Channel Temperature



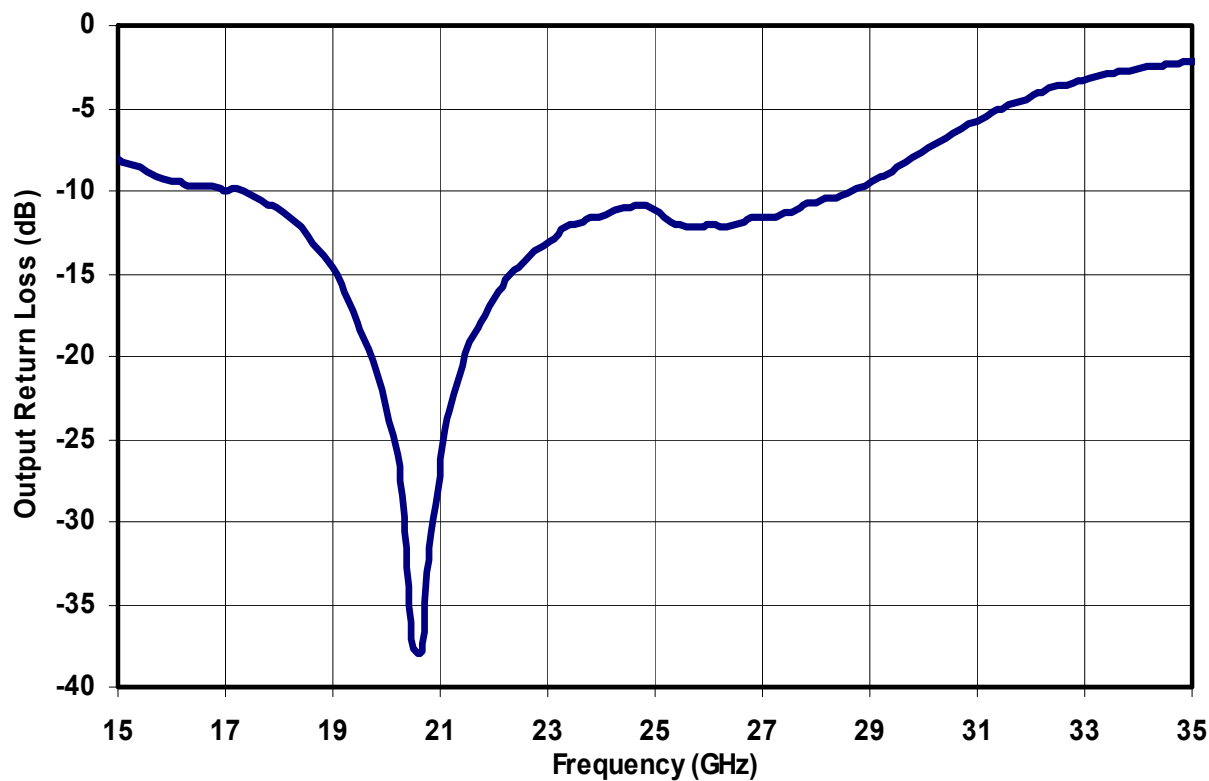
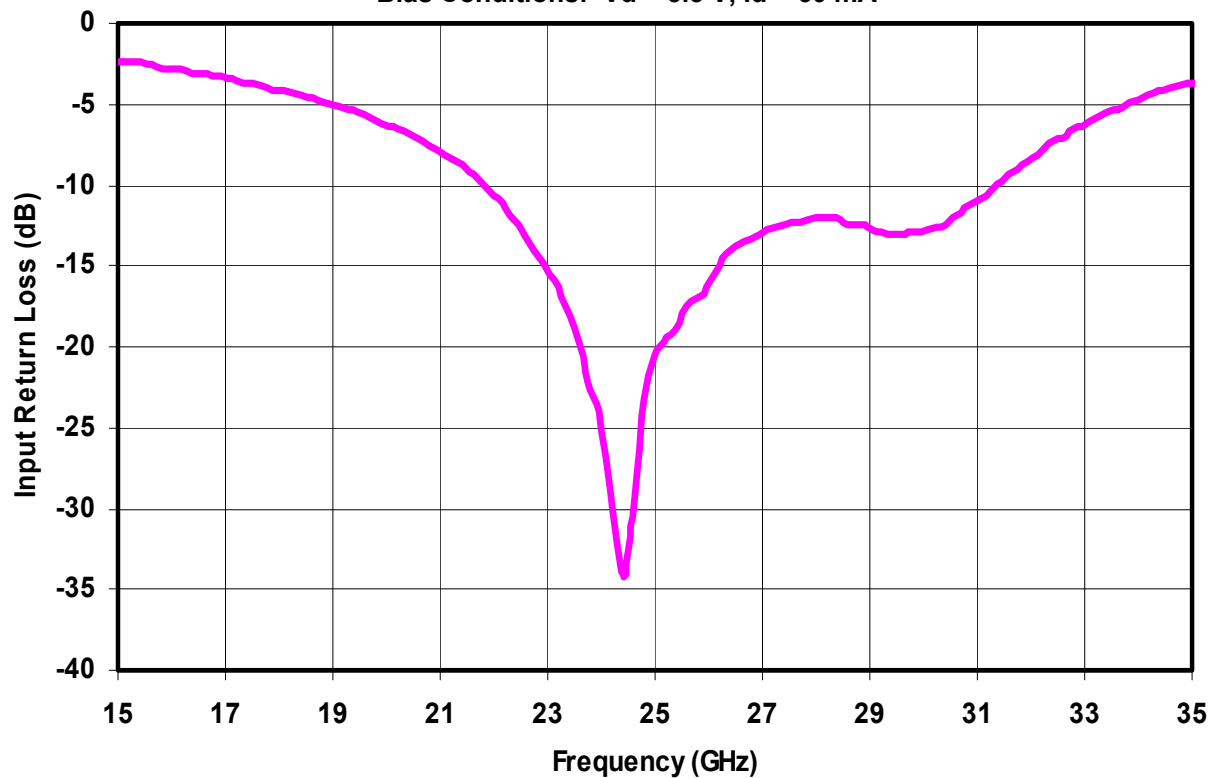
Measured Data

Bias Conditions: $V_d = 3.5\text{ V}$, $I_d = 60\text{ mA}$



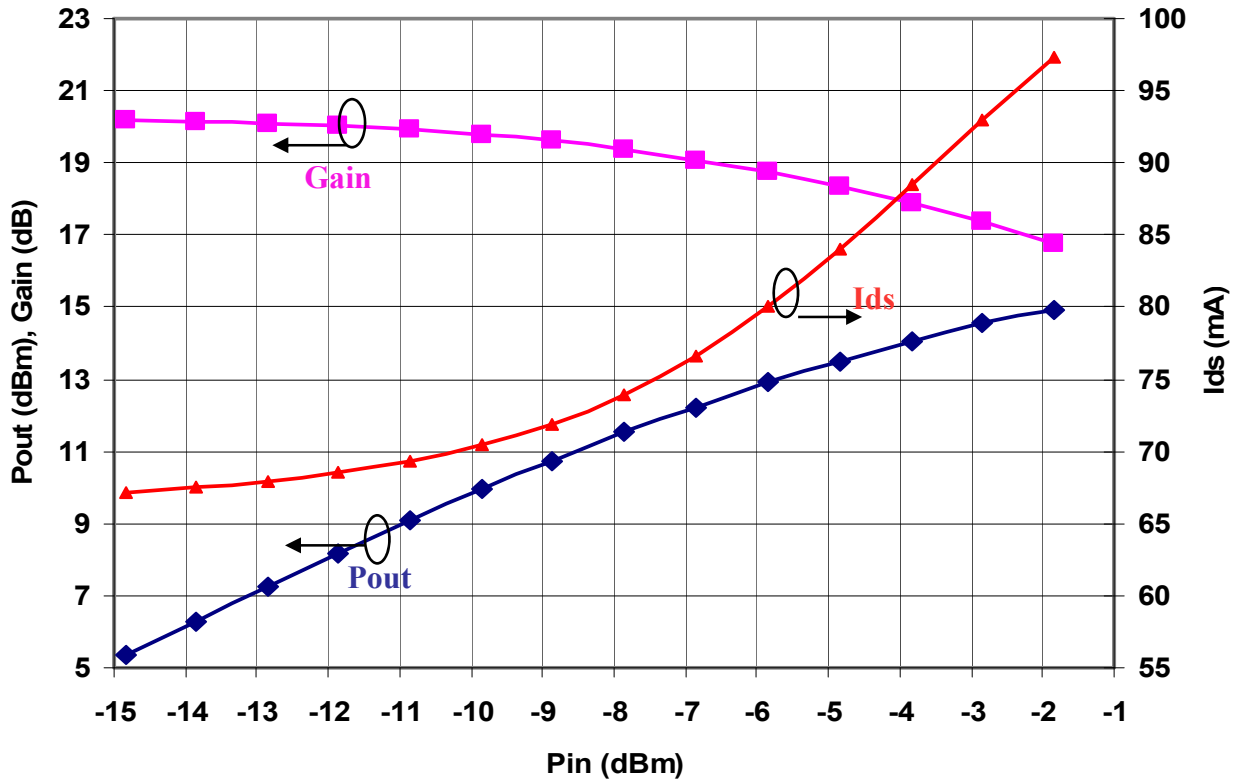
Measured Data

Bias Conditions: $V_d = 3.5\text{ V}$, $I_d = 60\text{ mA}$

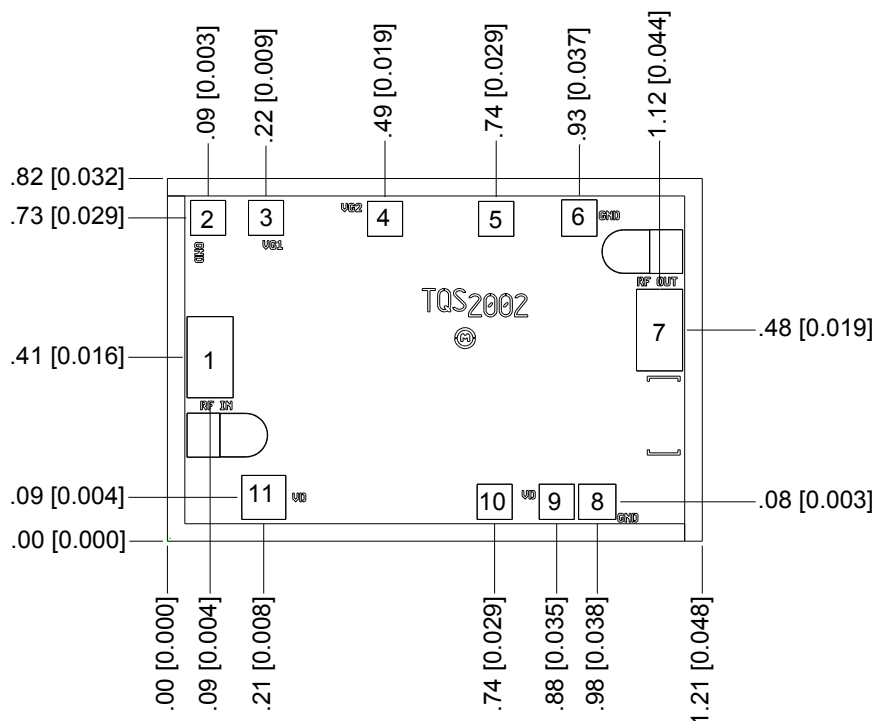


Measured Data

Bias Conditions: $V_d = 3.5$ V, $I_d = 60$ mA, Freq @ 24 GHz



Mechanical Drawing



Units: millimeters [inches]

Thickness: 0.10 [0.004] (reference only)

Chip edge to bond pad dimensions are shown to center of bond pads.

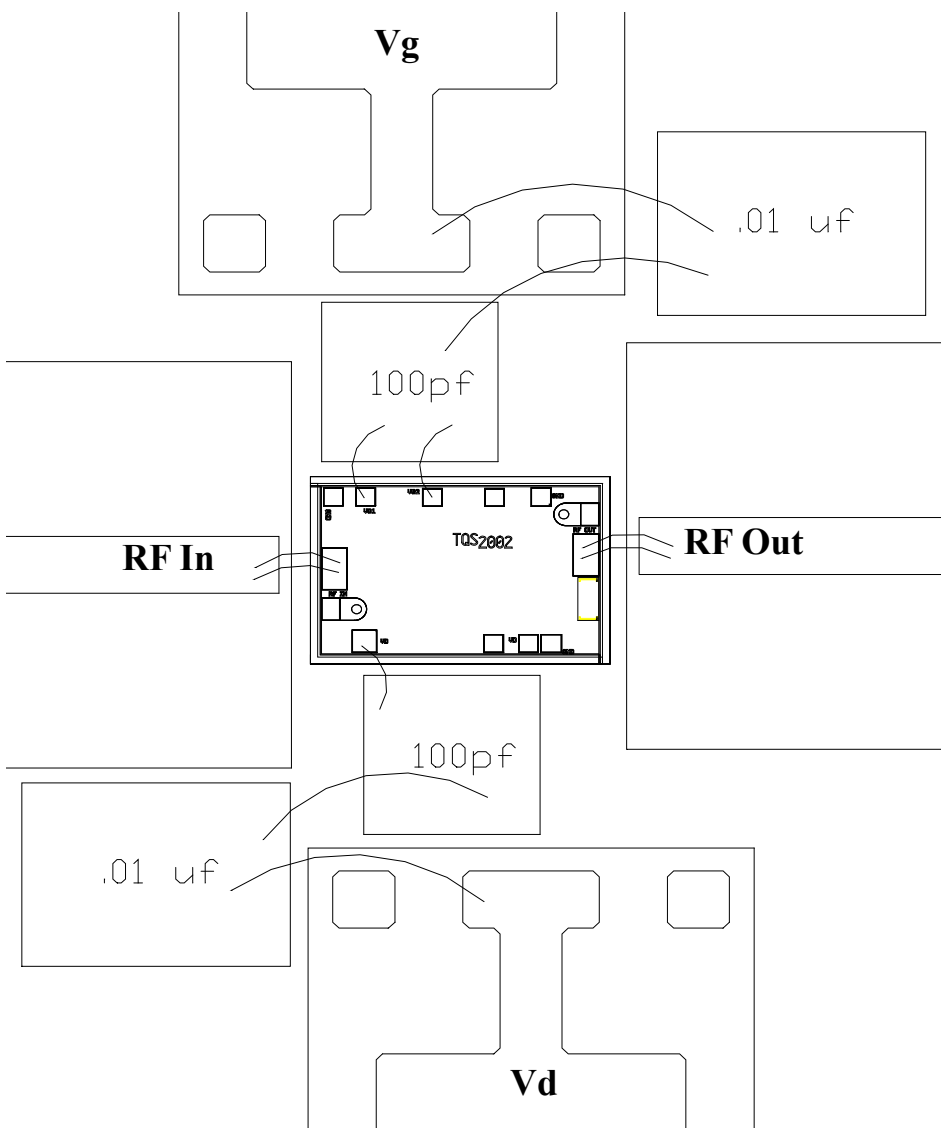
Chip size tolerance: ± 0.05 [0.002]

RF ground through backside

Bond Pad #1	RF Input	0.11 x 0.19	[0.004 x 0.007]
Bond Pad #2	N/C	0.08 x 0.08	[0.003 x 0.003]
Bond Pad #3	VG1	0.08 x 0.08	[0.003 x 0.003]
Bond Pad #4	VG2	0.08 x 0.08	[0.003 x 0.003]
Bond Pad #5	N/C	0.08 x 0.08	[0.003 x 0.003]
Bond Pad #6	N/C	0.08 x 0.08	[0.003 x 0.003]
Bond Pad #7	RF Output	0.11 x 0.19	[0.004 x 0.007]
Bond Pad #8	N/C	0.09 x 0.08	[0.004 x 0.003]
Bond Pad #9	VD	0.09 x 0.08	[0.004 x 0.003]
Bond Pad #10	VD	0.09 x 0.08	[0.004 x 0.003]
Bond Pad #11	VD	0.10 x 0.10	[0.004 x 0.004]

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

Chip Assembly Diagram



**All three Vd pads (pad # 9, 10, 11 from mechanical drawing)
do not need to be connected**

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

Assembly Process Notes

Reflow process assembly notes:

- Use AuSn (80/20) solder with limited exposure to temperatures at or above 300°C (30 seconds max).
- An alloy station or conveyor furnace with reducing atmosphere should be used.
- No fluxes should be utilized.
- Coefficient of thermal expansion matching is critical for long-term reliability.
- Devices must be stored in a dry nitrogen atmosphere.

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 can be used in low-power applications.
- Curing should be done in a convection oven; proper exhaust is a safety concern.
- Microwave or radiant curing should not be used because of differential heating.
- Coefficient of thermal expansion matching is critical.

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.
- Maximum stage temperature is 200°C.

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