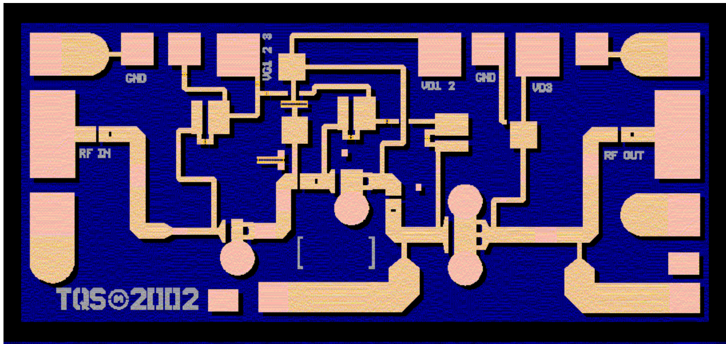
Ka Band Low Noise Amplifier

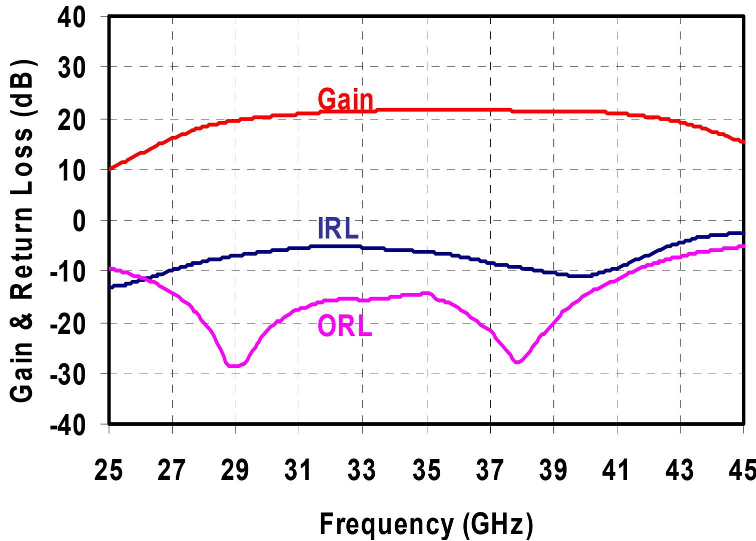


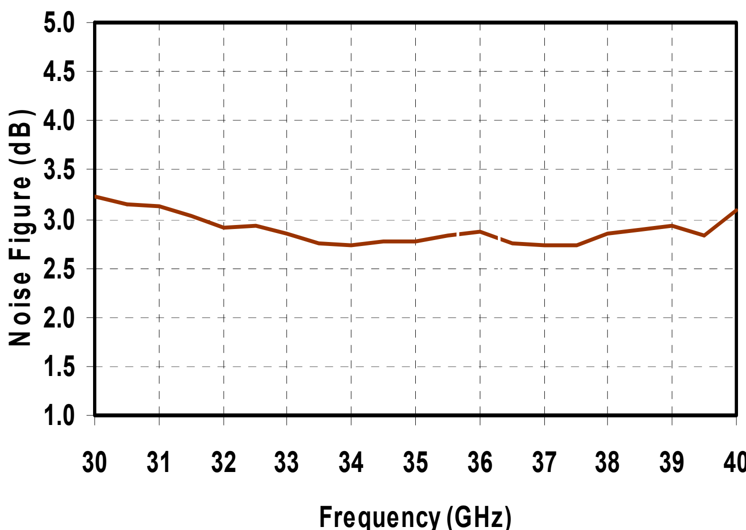
Key Features

- Typical Frequency Range: 30 - 42 GHz
- 21 dB Nominal Gain
- 2.8 dB Nominal Noise Figure
- 14 dBm Nominal P1dB @ 38 GHz
- Bias 3 V, 40mA
- 0.15 um 3MI pHEMT Technology
- Chip Dimensions 1.7 x 0.8 x 0.1 mm
  (0.067 x 0.031 x 0.004) in

Preliminary Measured Data

Bias Conditions: Vd = 3 V, Id = 40 mA





Primary Applications

- Point-to-Point Radio
- Point-to-MultiPoint Radio
- Ka Band VSAT

Datasheet subject to change without notice

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TABLE I
MAXIMUM RATINGS 1/

SYMBOL	PARAMETER	VALUE	NOTES
V^+	Positive Supply Voltage	5 V	2/
Vg1	Gate 1 Supply Voltage Range	-1 V TO 0 V	
I^+	Positive Supply Current	190 mA	2/
$\mid I_G \mid$	Gate Supply Current	6 mA	
P_{IN}	Input Continuous Wave Power	12 dBm	2/
P_D	Power Dissipation	0.95 W	2/, 3/
T_{CH}	Operating Channel Temperature	200 °C	4/, 5/
	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/ Current is defined under no RF drive conditions. Combinations of supply voltage, supply current, input power, and output power shall not exceed P_D.

3/ When operated at this power dissipation with a base plate temperature of 70 °C, the median life is 3.0E3 hours.

4/ Junction operating temperature will directly affect the device median time to failure (Tm). For maximum life, it is recommended that junction temperatures be maintained at the lowest possible levels.

5/ These ratings apply to each individual FET.

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

SYMBOL	PARAMETER	MINIMUM	MAXIMUM	UNITS
V_{BVGS3}	Breakdown Voltage gate-source	-30	-5	V
V_{BVGD3}	Breakdown Voltage gate-drain	-30	-5	V
$V_{P1,2,3}$	Pinch-off Voltage	-1.0	-0.1	V

Q1 is 100 um FET, Q2 is 200 um FET, Q3 is 300 um FET

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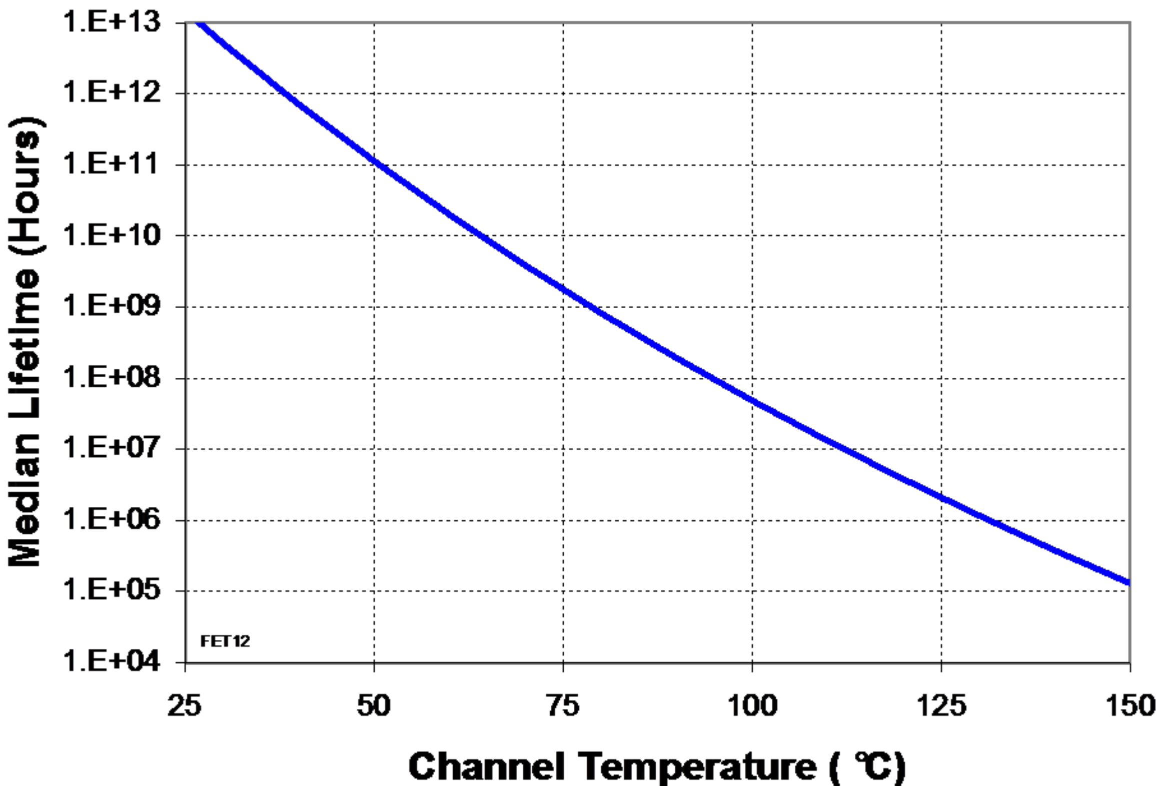
TABLE III
ELECTRICAL CHARACTERISTICS
(Ta = 25 °C, Nominal)

PARAMETER	TYPICAL	UNITS
Drain Voltage, Vd	3	V
Drain Current, Id	40	mA
Gate Voltage, Vg	-0.5 to 0	V
Small Signal Gain, S21	21	dB
Input Return Loss, S11	8	dB
Output Return Loss, S22	15	dB
Noise Figure, NF	2.8	dB
Output Power @ 1 dB Compression Gain @ 38 GHz, P1dB	14	dBm

TABLE IV
THERMAL INFORMATION

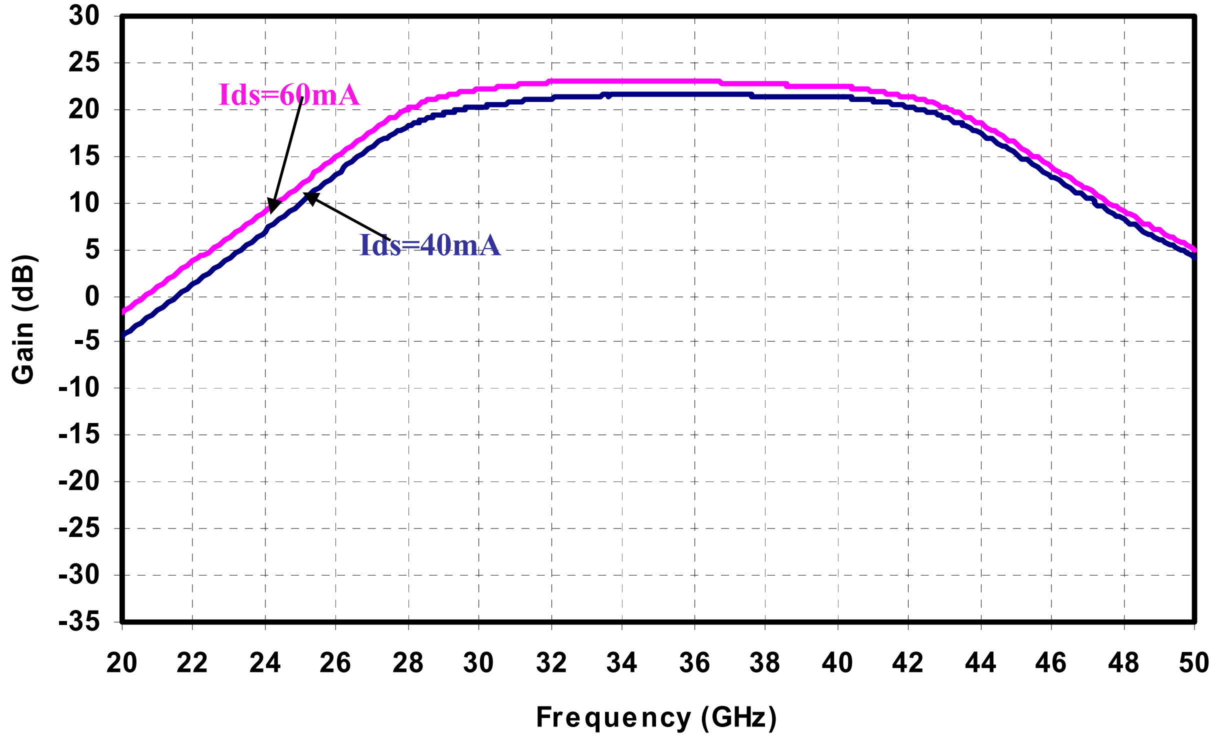
PARAMETER	TEST CONDITIONS	T_{CH} (°C)	θ_{JC} (°C/W)	Tm (HRS)
θ_{JC} Thermal Resistance (channel to backside of carrier)	Vd = 3 V I_D = 40 mA Pdiss = 0.12 W	85	125	3E+7

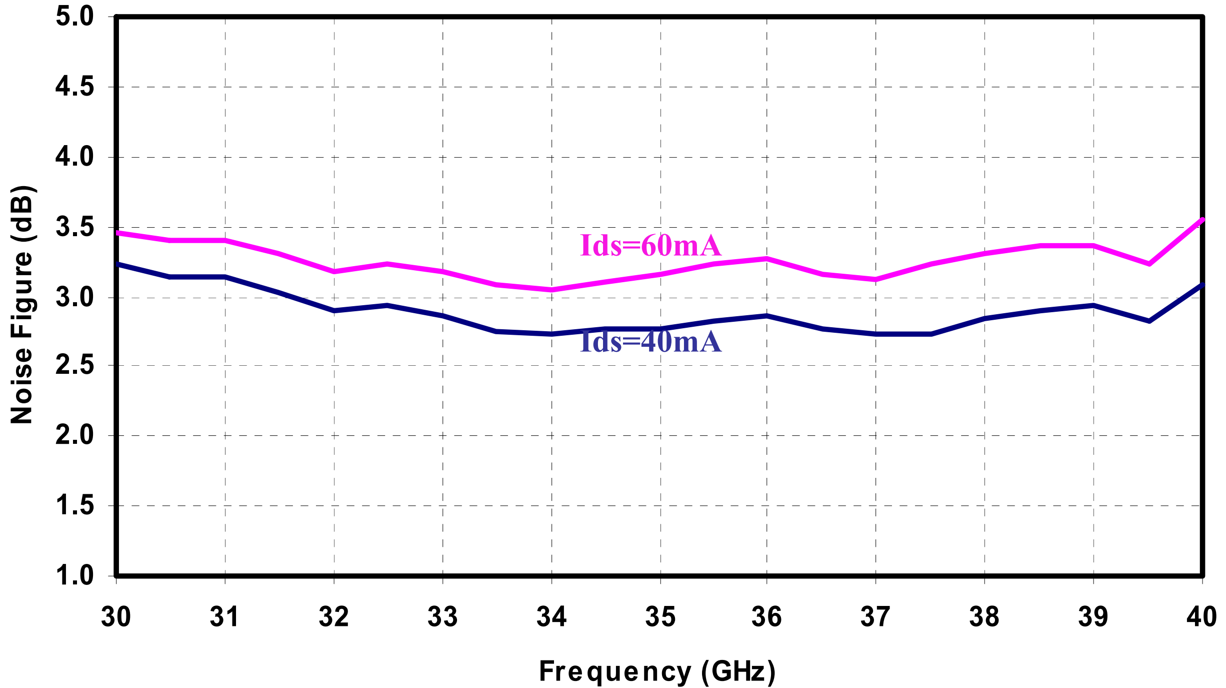
Note: Assumes eutectic attach using 1.5 mil 80/20 AuSn mounted to a 20 mil CuMo Carrier at 70°C baseplate temperature. Worst case condition with no RF applied, 100% of DC power is dissipated.



Measured Data

Bias Conditions: Vd = 3 V, Id = 40mA/60mA





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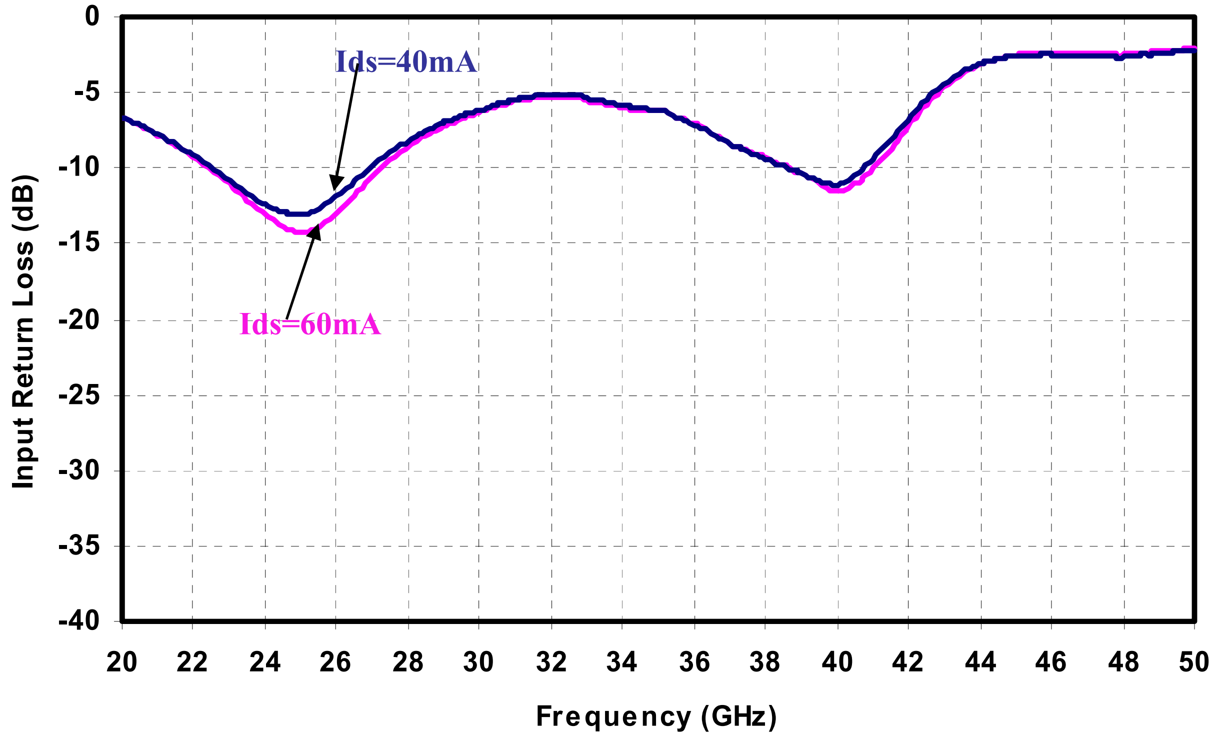
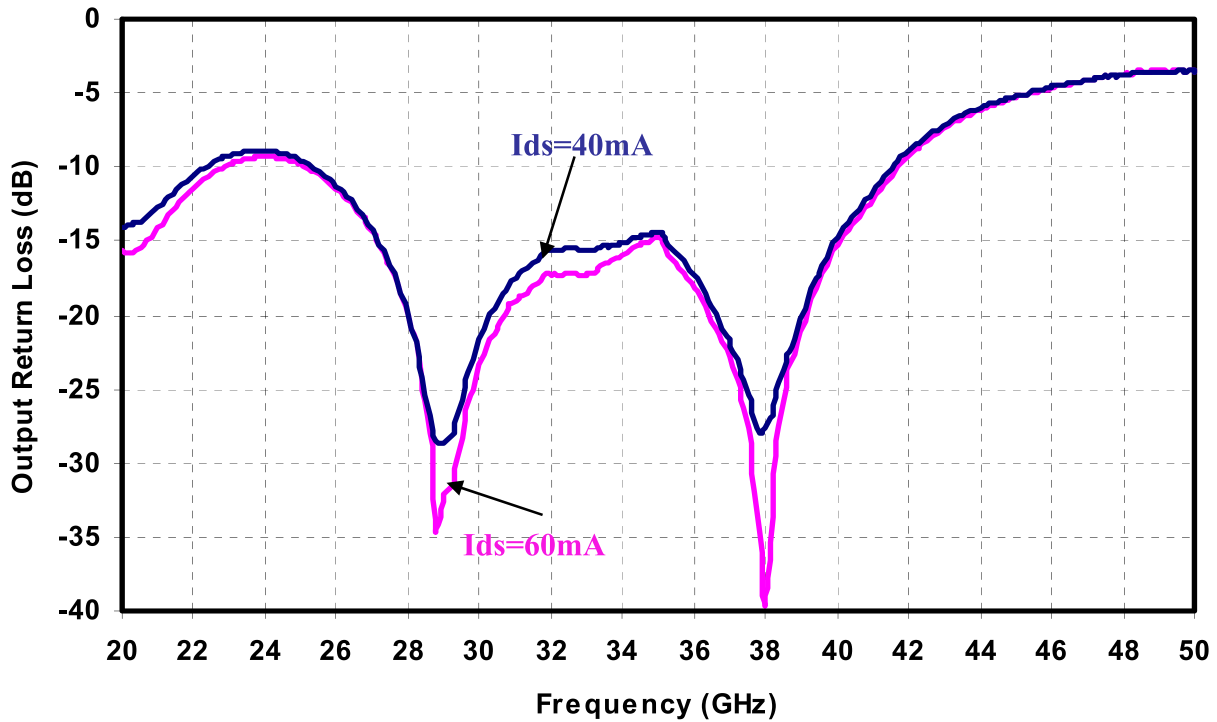
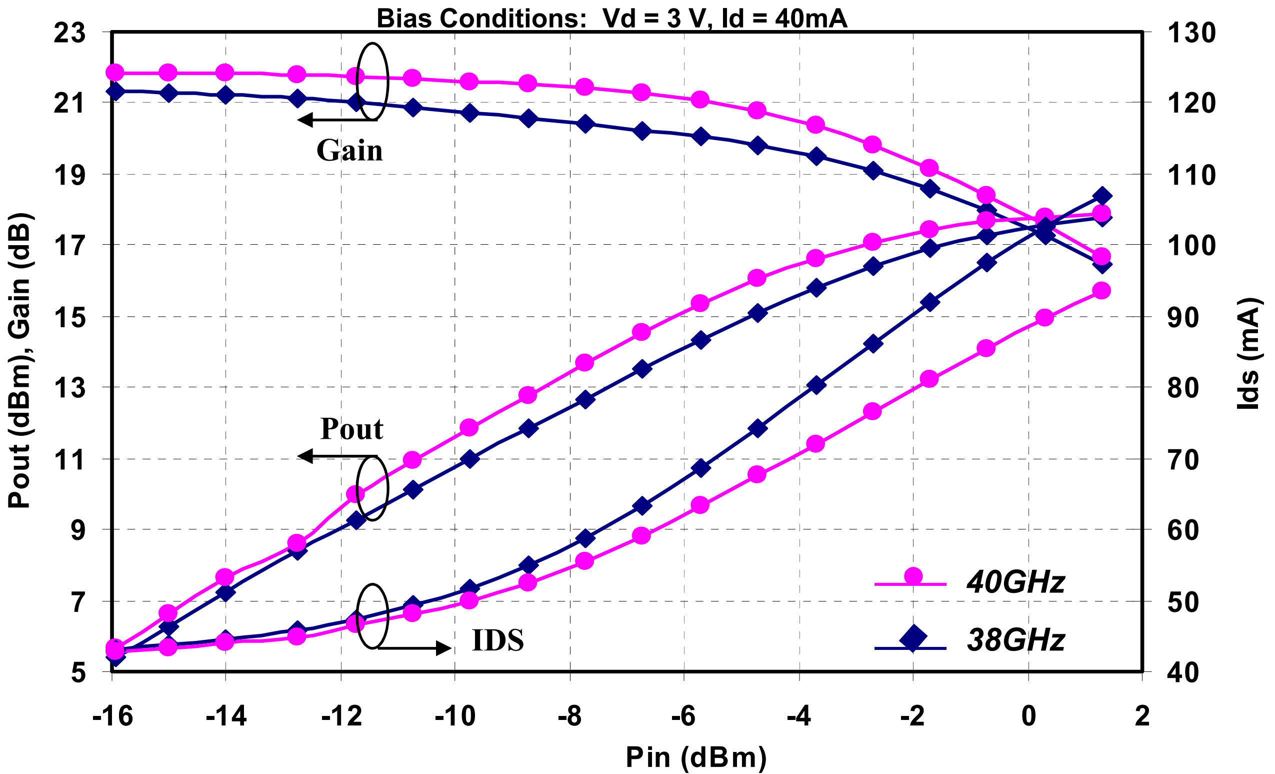
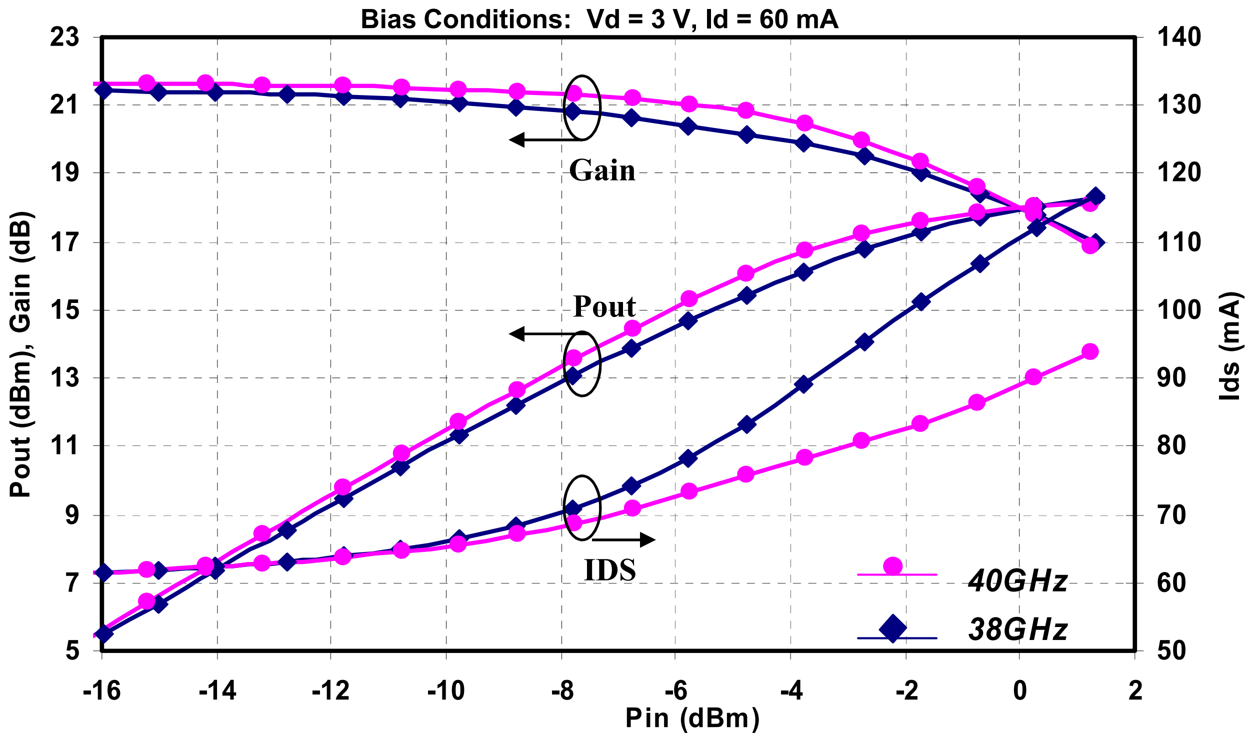




Measured Data





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Measured Data

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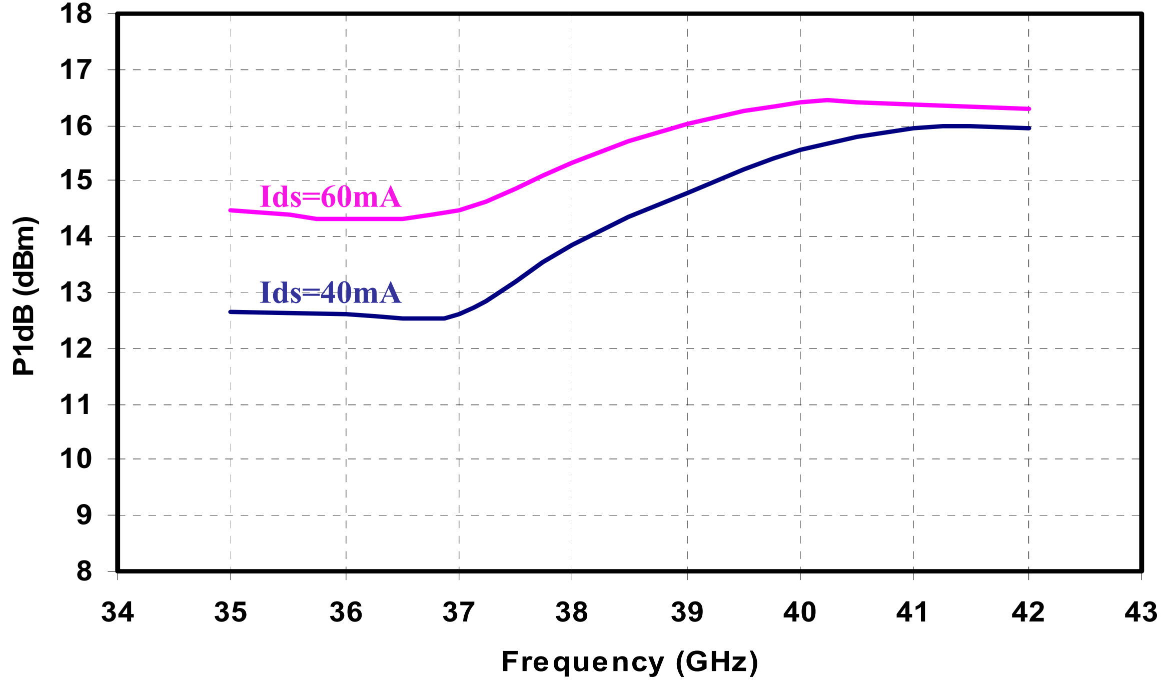
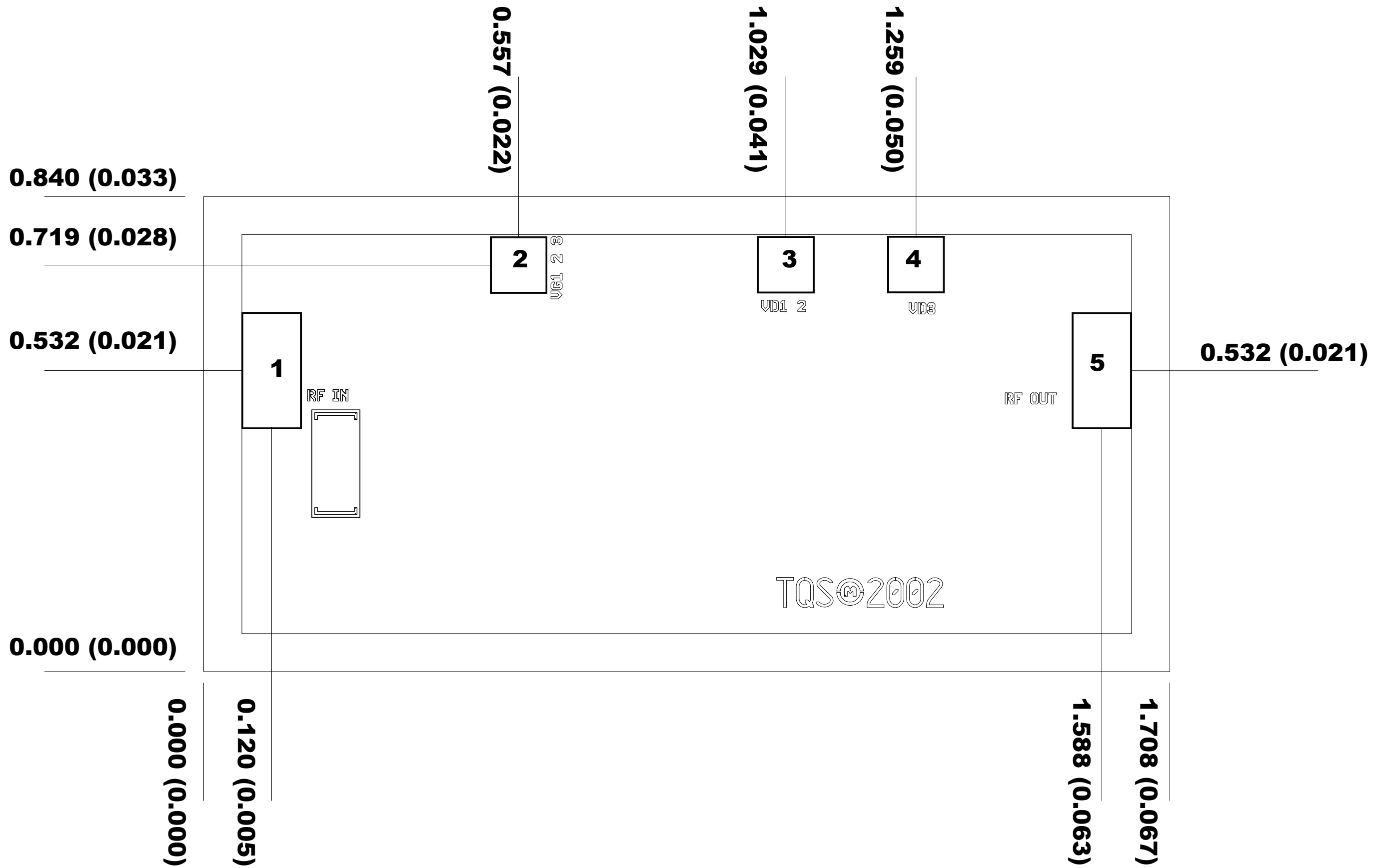


Mechanical Drawing



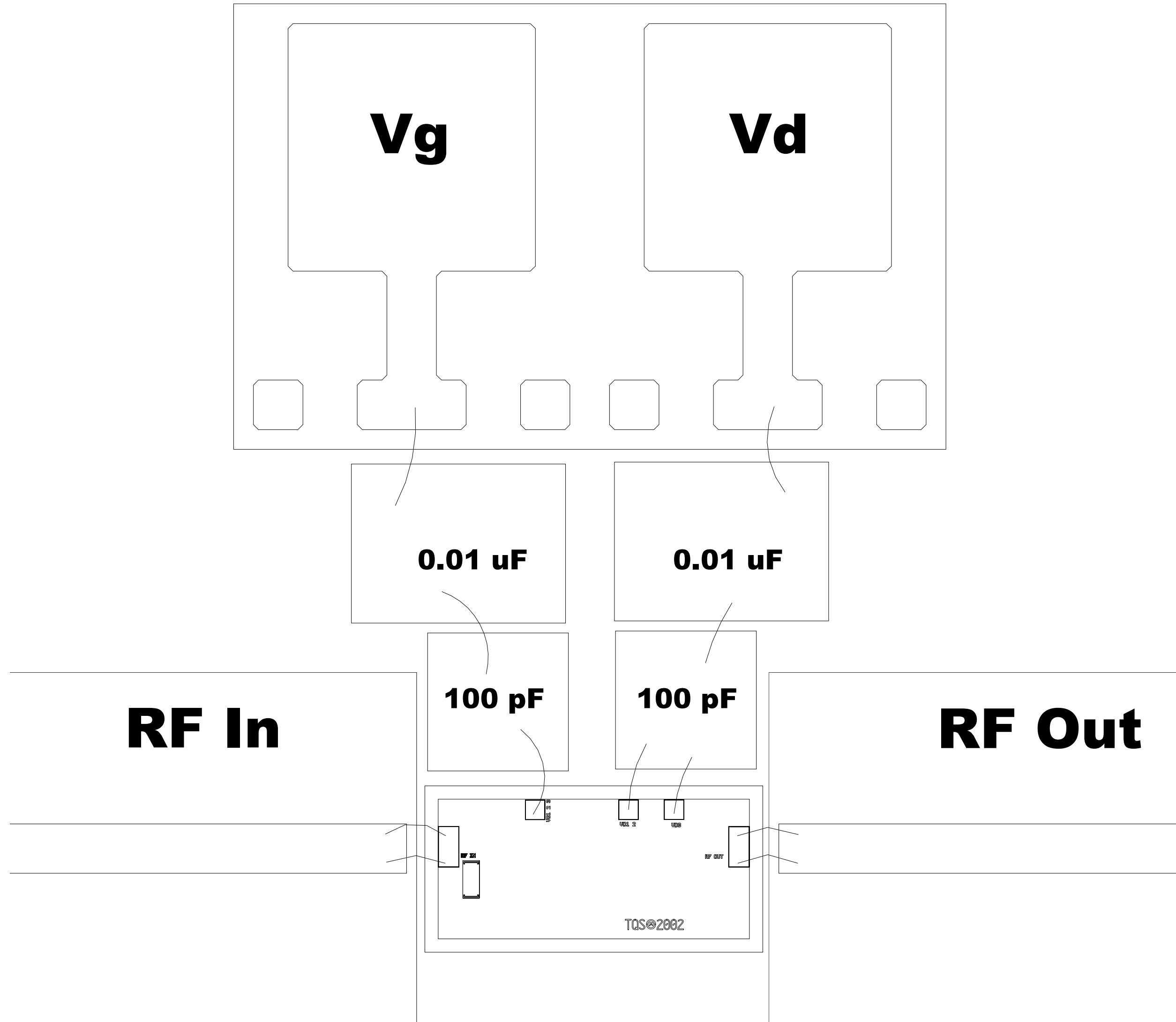
Units: Millimeters (Inches)
Thickness: 0.100 (0.004)
Chip edge to bond pad dimensions are shown to center of bond pad
Chip size tolerance: +/- 0.051 (0.002)

GND IS BACKSIDE OF MMIC

Bond pad #1	**(RF In)**	**0.100 x 0.200 (0.004 x 0.008)**
Bond pad #2	**(Vg)**	**0.100 x 0.100 (0.004 x 0.004)**
Bond pad #3	**(Vd1,2)**	**0.100 x 0.100 (0.004 x 0.004)**
Bond pad #4	**(Vd3)**	**0.100 x 0.100 (0.004 x 0.004)**
Bond pad #5	**(RF Out)**	**0.100 x 0.200 (0.004 x 0.008)**

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

Chip Assembly Diagram



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Assembly Process Notes

Reflow process assembly notes:

- Use AuSn (80/20) solder with limited exposure to temperatures at or above 300 °C for 30 sec
- 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.
- Devices with small pad sizes should be bonded with 0.0007-inch wire.
- Maximum stage temperature is 200 °C.

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