Features

- Output Power: 500 W
- Large Signal Gain: 12 dB
- Drain Efficiency: 55%
- Internally Matched: 50 Ω
- High Temperature Operation
- RoHS* Compliant

Applications

- Civil & Military Pulsed Radar Amplifiers

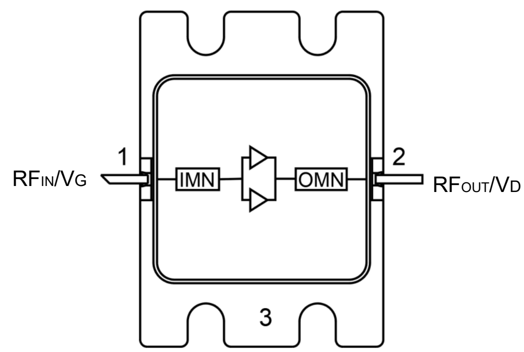
Description

The MAPC-A4032 is a Gallium Nitride (GaN) amplifier designed specifically with high efficiency and high power for the 2.75 - 3.75 GHz S-Band radar band.

The amplifier is matched to 50 Ω on the input and 50 Ω on the output. At the core of MAPC-A4032 is the high power density 65 V GaN-on-Silicon Carbide (SiC) manufacturing process. The amplifier is supplied in a ceramic/metal flange package of type AC-587BH-2

AC-587BH-2

Functional Schematic



Typical RF Performance:

Measured in Evaluation Test Fixture at P_{IN} = 46 dBm, 100 μs pulse width and 10% Duty Cycle.

Frequency (GHz)	Output Power (dBm)	Power Gain (dB)	η_D (%)
2.75	56.6	10.6	33.3
2.9	58.8	12.9	51.4
3.3	58.5	12.5	53.4
3.5	58.1	12.1	56.1
3.75	57.7	11.7	57.9

Pin Configuration

Pin #	Pin Name	Function
1	RF_{IN} / V_G	RF Input / Gate
2	RF_{OUT} / V_D	RF Output / Drain
3	Flange[1]	Ground / Source

1. The flange on the package bottom must be connected to RF, DC and thermal ground.

Ordering Information

Part Number	MOQ Increment
MAPC-A4032-AB000	Bulk
MAPC-A4032-ABSB1	Sample Board

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

RF Electrical Characteristics: Freq. = 2.75 - 3.75 GHz, T_C = 25°C, V_{DS} = 65 V, I_{DQ} = 500 mA, Pulse Width = 100 µs, Duty Cycle = 10%

Performance in MACOM Evaluation Test Fixture, 50 Ω system

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Output Power	Pulsed, P_{IN} = 46 dBm	P_{OUT}	—	58.5	—	dBm
Drain Efficiency	Pulsed, P_{IN} = 46 dBm	DE	—	53.5	—	%
Large Signal Gain	Pulsed, P_{IN} = 46 dBm	G_P	—	12.5	—	dB
Small Signal Gain	CW, P_{IN} = -30 dBm	S21	—	13	—	dB
Input Return Loss	CW, P_{IN} = -30 dBm	S11	—	-7	—	dB
Output Return Loss	CW, P_{IN} = -30 dBm	S22	—	-4	—	dB
Output Mismatch Stress	V_{DD} = 65 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm	ψ	VSWR =10:1, No Device Damage			

RF Electrical Specifications[2]: P_{IN} = 46 dBm, T_A = +25°C, V_{DS} = 65 V, I_{DQ} = 500 mA, Pulse Width 100 µs, 10% Duty Cycle

Parameter	Conditions	Units	Min.	Typ.	Max.
Output Power	2.90 GHz 3.30 GHz 3.50 GHz 3.75 GHz	W	560 560 500 500	675 640 615 600	—
Power Gain	2.90 GHz 3.30 GHz 3.50 GHz 3.75 GHz	dB	11.4 11.4 11.0 11.0	12.3 12.1 11.9 11.8	—
Drain Efficiency	2.90 GHz 3.30 GHz 3.50 GHz 3.75 GHz	%	40 45 50 50	46 49 55 57	—

2. Final testing and screening for all amplifier sales is performed using the MAPC-A4032 production test fixture.

DC Electrical Characteristics T_A = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{DLK}	—	—	11.62	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{GLK}	-11.62	—	—	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 83.6 mA	V_T	-3.8	-3.1	-2.3	V
Gate Quiescent Voltage	V_{DS} = 65 V, I_D = 500 mA	V_{GSQ}	—	-2.75	—	V

Thermal Characteristics

Parameter	Symbol	Test Conditions	Units	Rating
Operating Junction Temperature	T_J	Pulse Width = 100 µs , Duty Cycle = 10%, P_{DISS} = 427 W, T_C = 85°C	°C	136
Thermal Resistance, Junction to Case	$R_{\theta JC}$		°C/W	0.12

Parameter	Symbol	Test Conditions	Units	Rating
Operating Junction Temperature	T_J	CW, P_{DISS} = 200 W, T_C = 85°C	°C	185
Thermal Resistance, Junction to Case	$R_{\theta JC}$		°C/W	0.5

Absolute Maximum Ratings[3,4]

Parameter	Absolute Maximum
Drain-Source Voltage	195 V
Gate Voltage	-10, +2 V
DC Drain Current	14 A
Gate Current	80 mA
Input Power	48 dBm
Storage Temperature	-65°C to +150°C
Mounting Temperature	+245°C for 30 seconds
Junction Temperature[5]	+225°C
Operating Temperature	-40°C to +125°C

3. Exceeding any one or combination of these limits may cause permanent damage to this device.
4. MACOM does not recommend sustained operation near these survivability limits.
5. Operating at nominal conditions with $T_J \leq$ +225 C will ensure MTTF ≥ 1 x 10^6 hours.

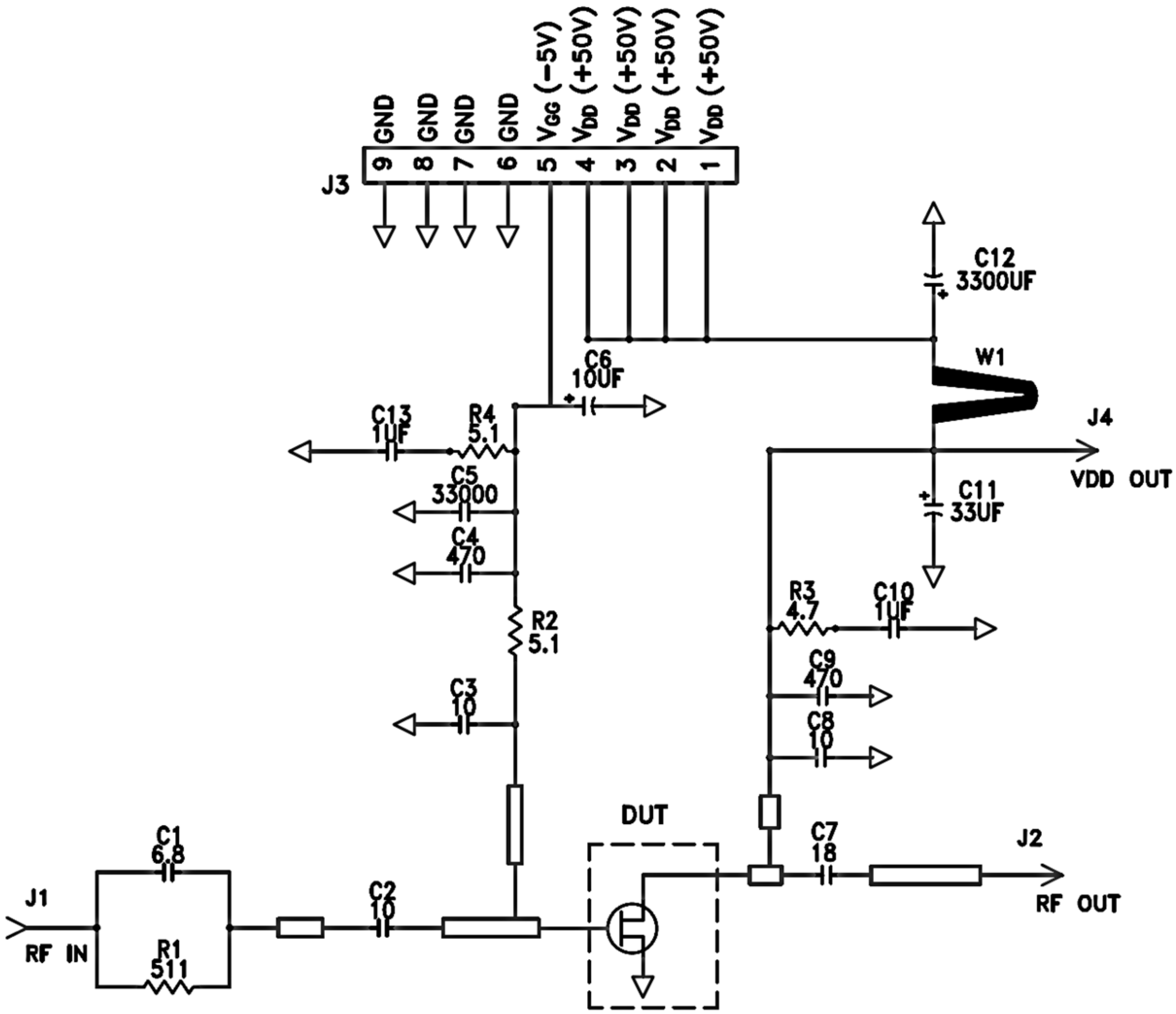
Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM Class 3A and CDM Class C3 devices.

Application Circuit Schematic



Description

Parts measured on evaluation board (30-mil thick TACONIC RF-35P, 2oz Copper). Matching is provided using a combination of lumped elements and transmission lines as shown in the simplified schematic above. Recommended tuning solution component placement, transmission lines, and details are shown on the next page.

Biasing Sequence

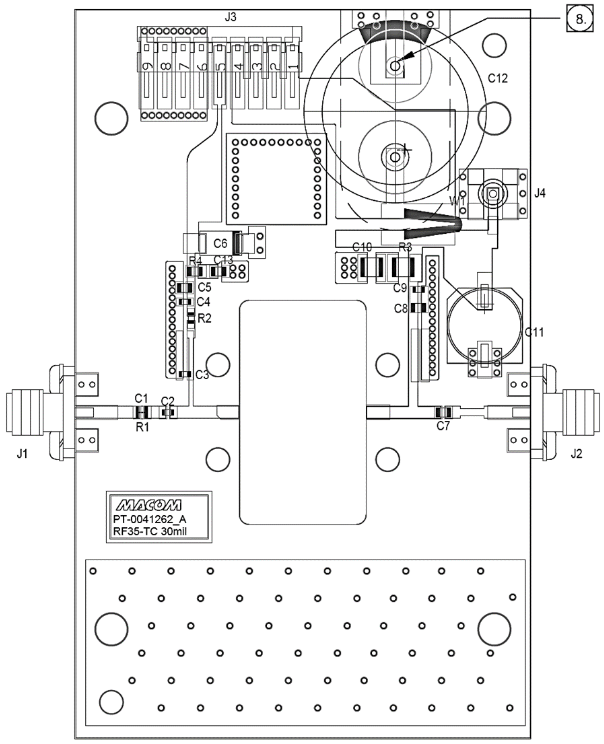
Bias ON

1. Ensure RF is turned off
2. Apply pinch-off voltage of -5 V to the gate
3. Apply nominal drain voltage
4. Bias gate to desired quiescent drain current
5. Apply RF

Bias OFF

1. Turn RF off
2. Apply pinch-off voltage of -5 V to the gate
3. Turn-off drain voltage
4. Turn-off gate voltage

Assembly Drawing



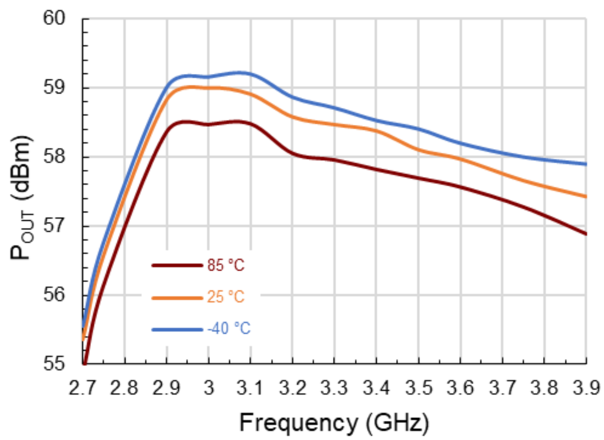
Assembly Parts List

Ref Des	Description	Qty
C1	CAP, 6.8pF, +/- 0.25 pF, 0603, ATC	1
C2,C8	CAP, 10pF, +/- 1%, 250V, 0805, ATC600F	2
C3	CAP, 10.0pF, +/-5%, 0603, ATC	1
C4,C9	CAP, 470PF, 5%,100V, 0603	2
C5	CAP,33000PF, 0805,100V, X7R	1
C6	CAP 10UF 16V TANTALUM, 2312	1
C7	CAP, 18pF, +/- 0.25 pF, 250V, 0805, ATC600F	1
C10	CAP, 1.0UF, 100V, +/-10%, X7R, 1210	1
R3	RES, 4.7 OHM, 1%, 1/4W, 1206	1
C13	CAP, 1UF, 0805, 100V, X7S	1
C11	CAP, 33 UF, 20%, G CASE	1
C12	CAP, 3300 UF, +/-20%, 100V, ELECTROLYTIC, VR, RADIAL	1
R1	RES,1/16W,0603,1%,511 OHMS	1
R2,R4	RES, 1/16W, 0603, 1%, 5.1 Ohms	1
J1,J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST	2
J3	HEADER RT>PLZ .1CEN LK 9POS	1
J4	CONN, SMB, STRAIGHT JACK RECEPTACLE, SMT, 50 OHM, Au PLATED	1
W1	WIRE ASSEMBLY, 4.2", 18 AWG, TEST FIXTURE	1

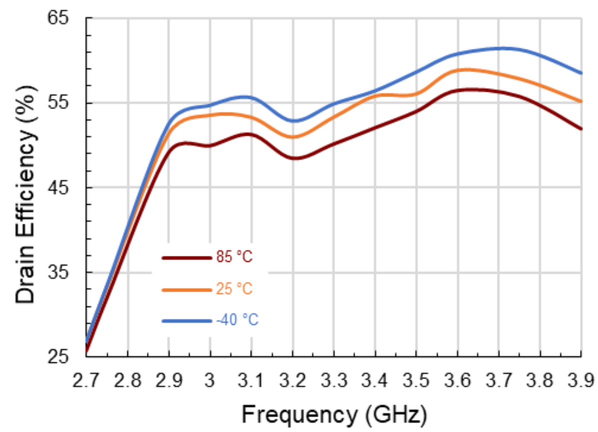
Typical Performance Curves as Measured in the 2.75 – 3.75 GHz Evaluation Test Fixture

Pulsed 100 µs 10%, P_{IN} = 46 dBm, V_{DS} = 65 V, I_{DQ} = 500 mA, Frequency = 3.5 GHz (Unless otherwise noted)
For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

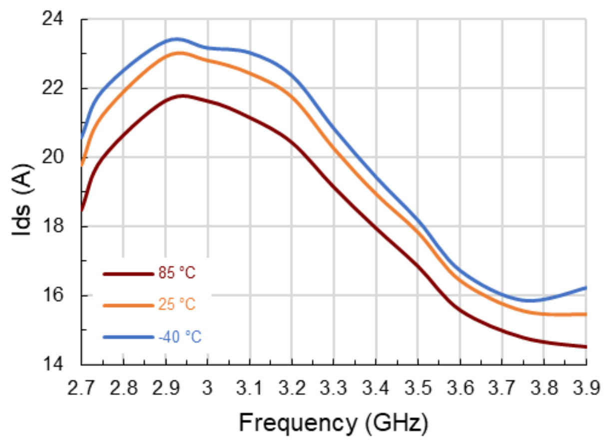
Output Power vs. Temperature and Frequency



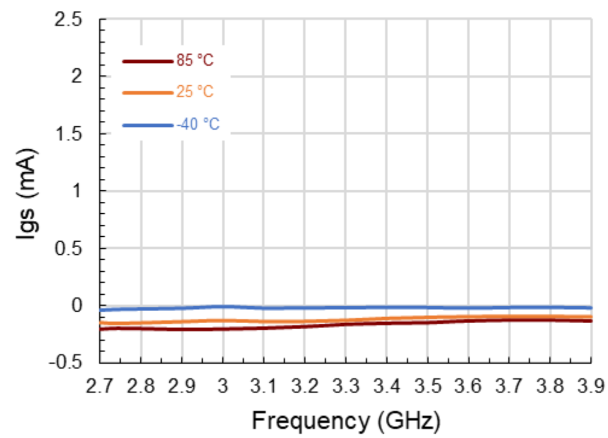
Drain Efficiency vs. Temperature and Frequency



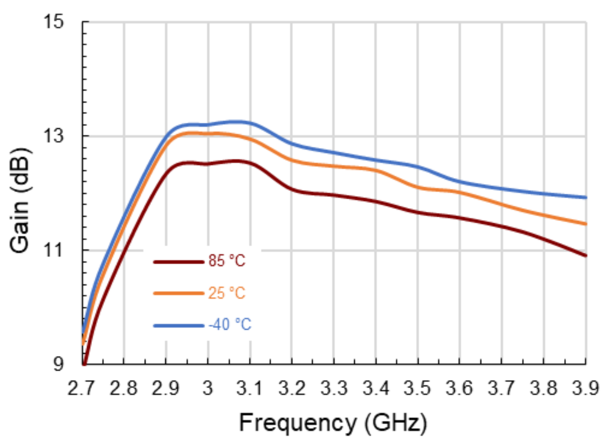
Drain Current vs. Temperature and Frequency



Gate Current vs. Temperature and Frequency



Large Signal Gain vs. Temperature and Frequency



Typical Performance Curves as Measured in the 2.75 – 3.75 GHz Evaluation Test Fixture

Pulsed 100 µs 10%, P_{IN} = 46 dBm, V_{DS} = 65 V, I_{DQ} = 500 mA, Frequency = 3.5 GHz (Unless otherwise noted)
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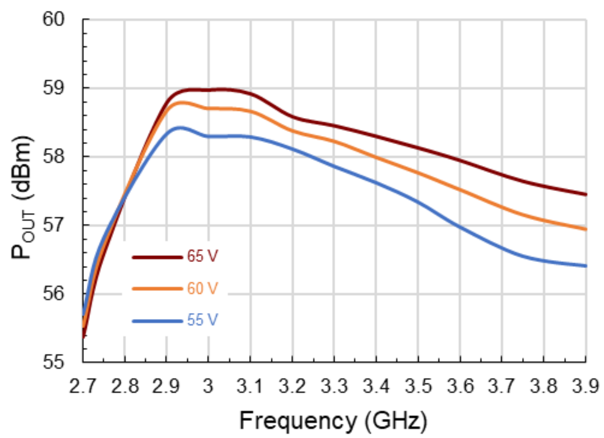
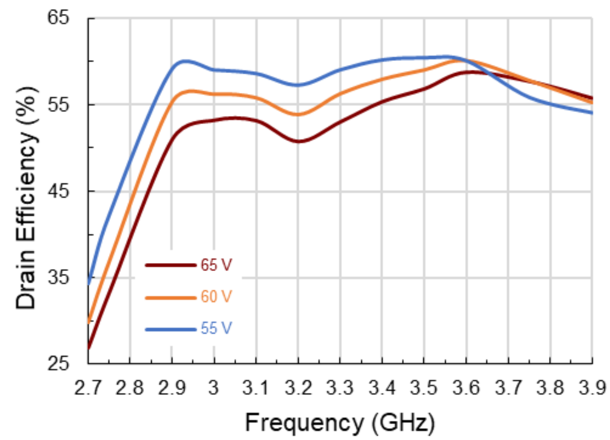
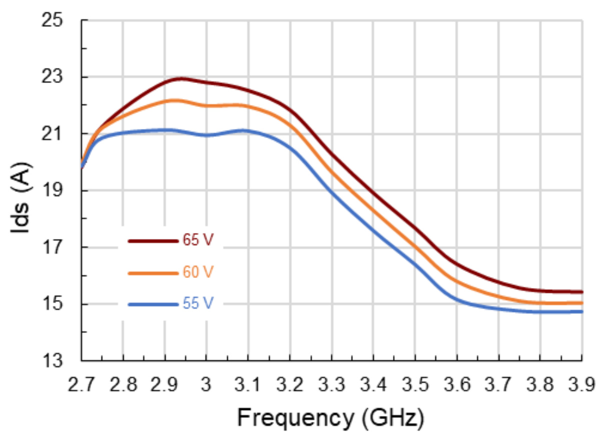
Output Power vs. V_{DS} and Frequency



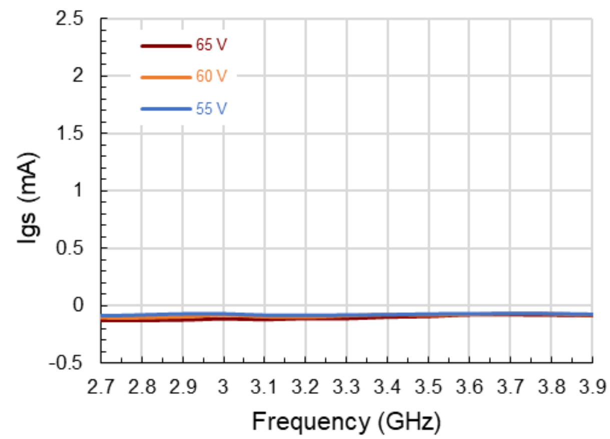
Drain Efficiency vs. V_{DS} and Frequency



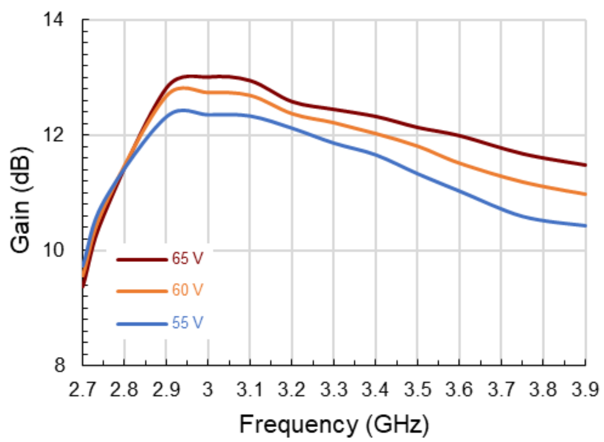
Drain Current vs. V_{DS} and Frequency



Gate Current vs. V_{DS} and Frequency



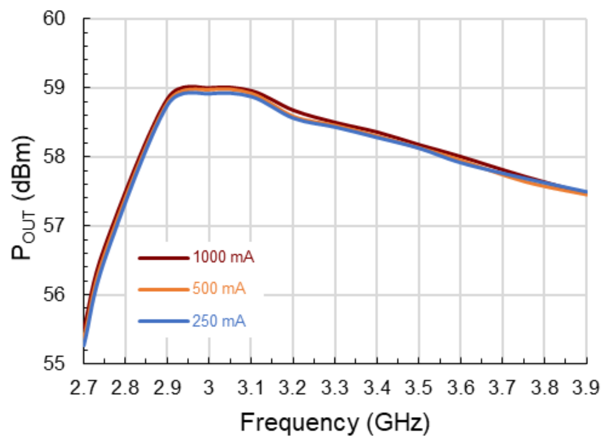
Large Signal Gain vs. V_{DS} and Frequency



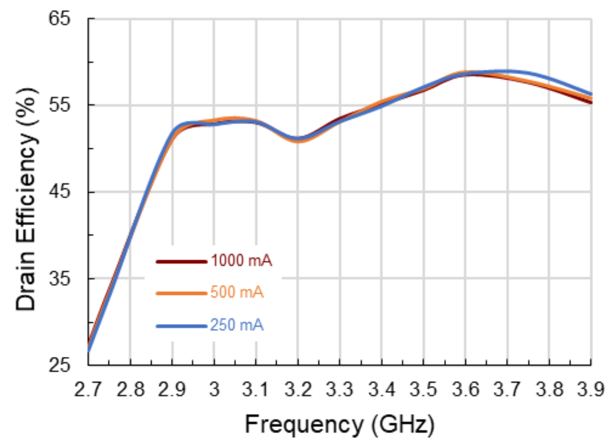
Typical Performance Curves as Measured in the 2.75 – 3.75 GHz Evaluation Test Fixture

Pulsed 100 µs 10%, P_{IN} = 46 dBm, V_{DS} = 65 V, I_{DQ} = 500 mA, Frequency = 3.5 GHz (Unless otherwise noted)
For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

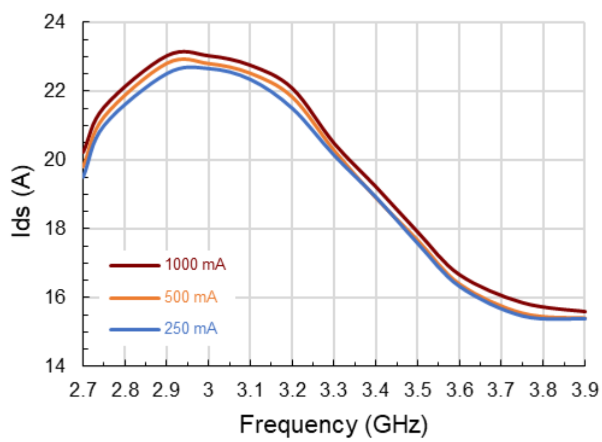
Output Power vs. I_{DQ} and Frequency



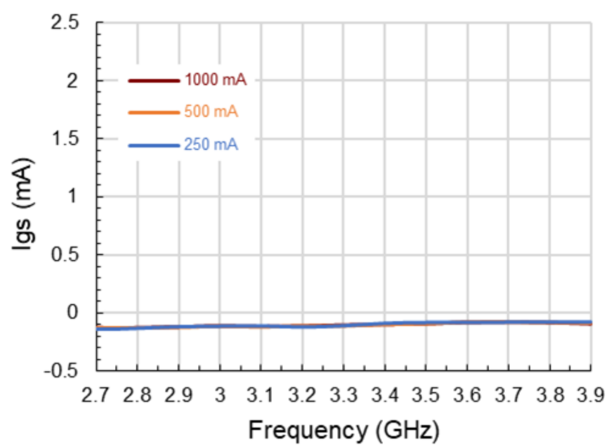
Drain Efficiency vs. I_{DQ} and Frequency



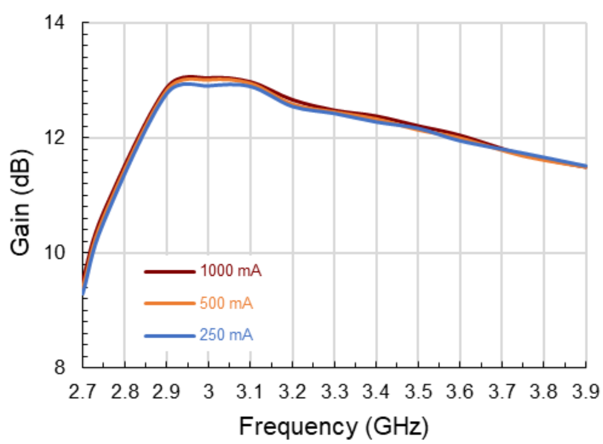
Drain Current vs. I_{DQ} and Frequency



Gate Current vs. I_{DQ} and Frequency



Large Signal Gain vs. I_{DQ} and Frequency



Typical Performance Curves as Measured in the 2.75 – 3.75 GHz Evaluation Test Fixture

Pulsed 100 µs 10%, P_{IN} = 46 dBm, V_{DS} = 65 V, I_{DQ} = 500 mA, Frequency = 3.5 GHz (Unless otherwise noted)
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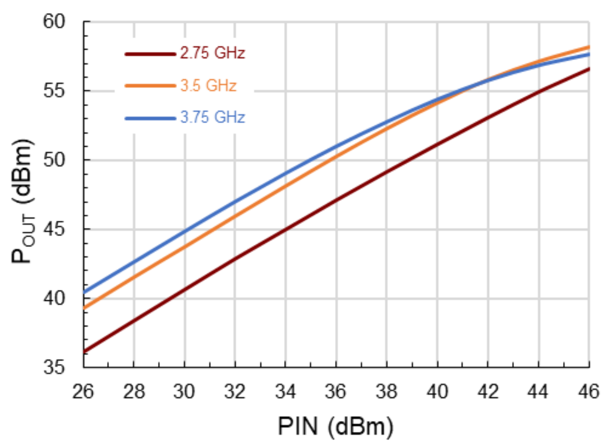
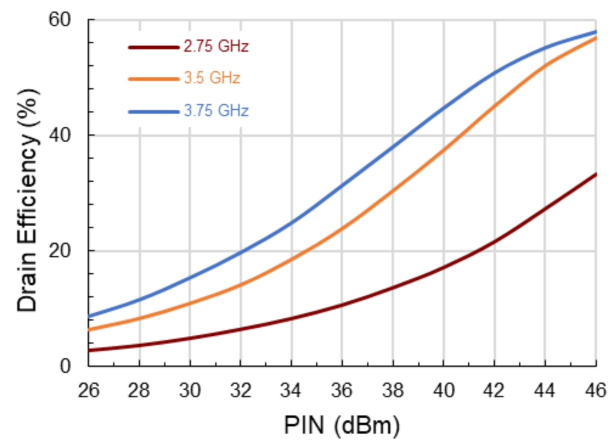
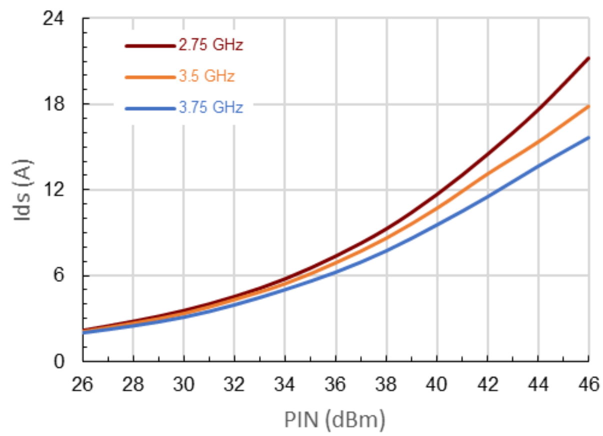
Output Power vs. Frequency and P_{IN}



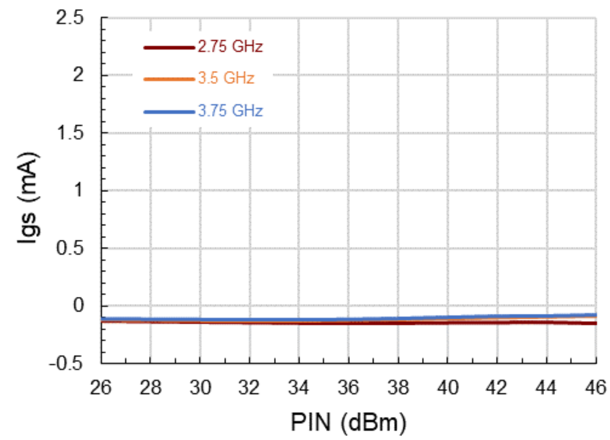
Drain Efficiency vs. Frequency and P_{IN}



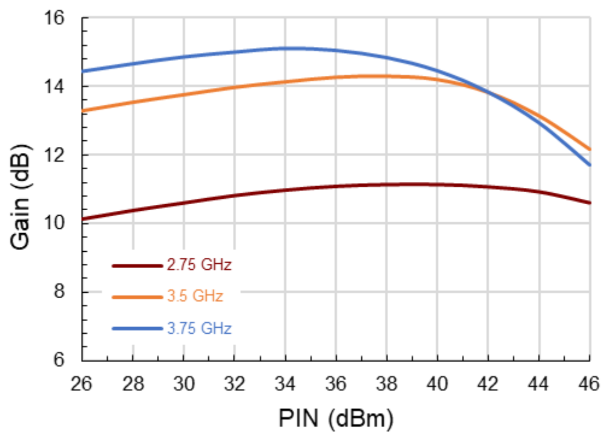
Drain Current vs. Frequency and P_{IN}



Gate Current vs. Frequency and P_{IN}



Large Signal Gain vs. Frequency and P_{IN}



Typical Performance Curves as Measured in the 2.75 – 3.75 GHz Evaluation Test Fixture

Pulsed 100 µs 10%, P_{IN} = 46 dBm, V_{DS} = 65 V, I_{DQ} = 500 mA, Frequency = 3.5 GHz (Unless otherwise noted)
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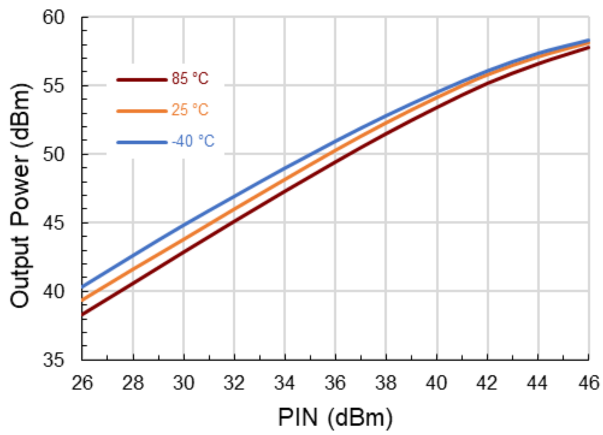
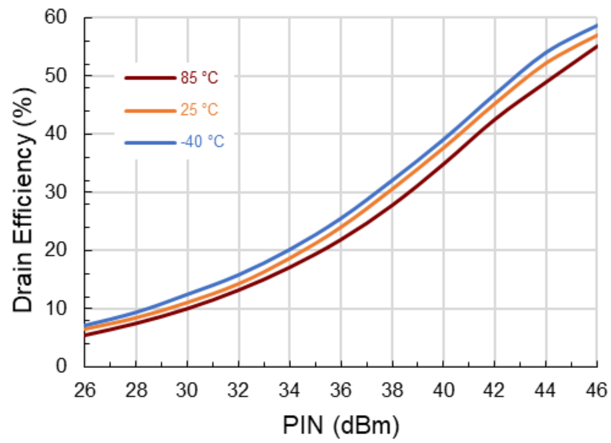
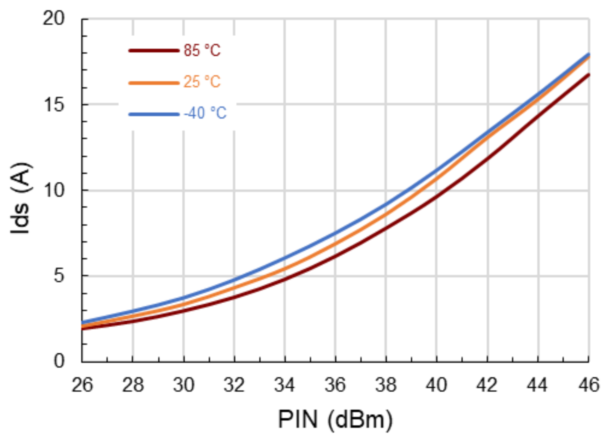
Output Power vs. Temperature and P_{IN}



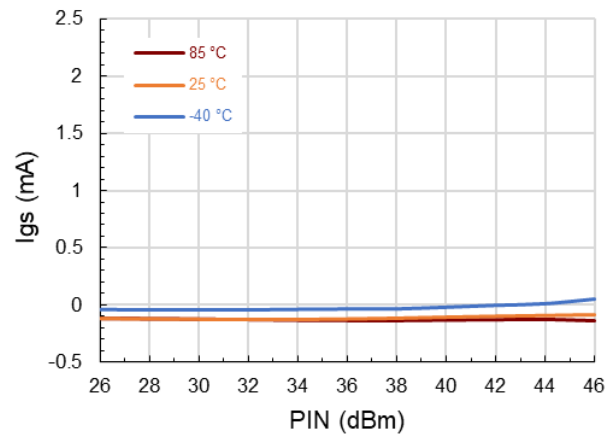
Drain Efficiency vs. Temperature and P_{IN}



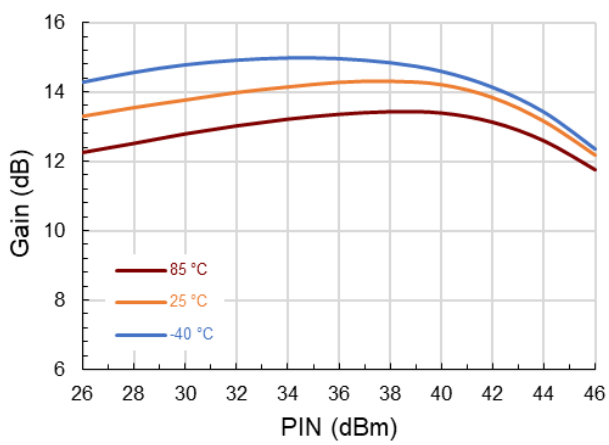
Drain Current vs. Temperature and P_{IN}



Gate Current vs. Temperature and P_{IN}



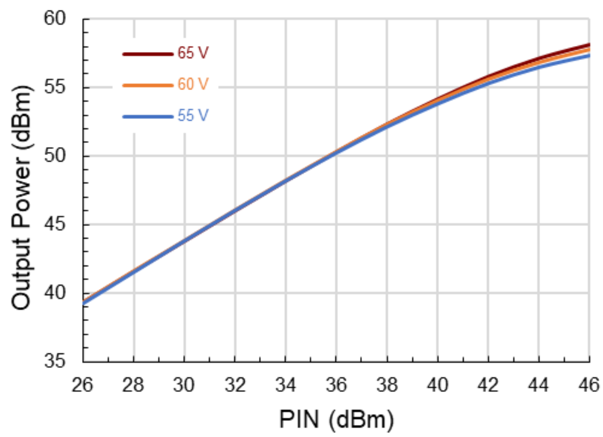
Large Signal Gain vs. Temperature and P_{IN}



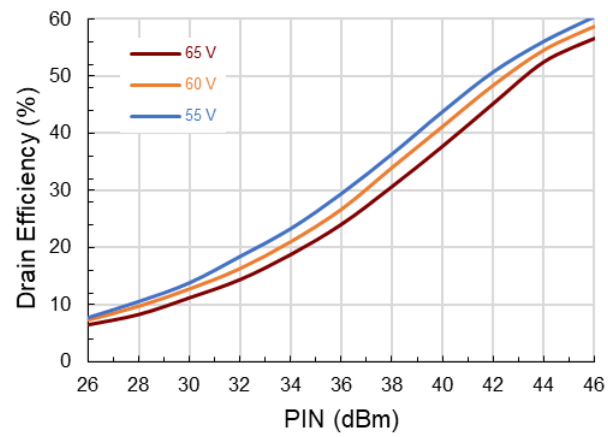
Typical Performance Curves as Measured in the 2.75 – 3.75 GHz Evaluation Test Fixture

Pulsed 100 µs 10%, P_{IN} = 46 dBm, V_{DS} = 65 V, I_{DQ} = 500 mA, Frequency = 3.5 GHz (Unless otherwise noted)
For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

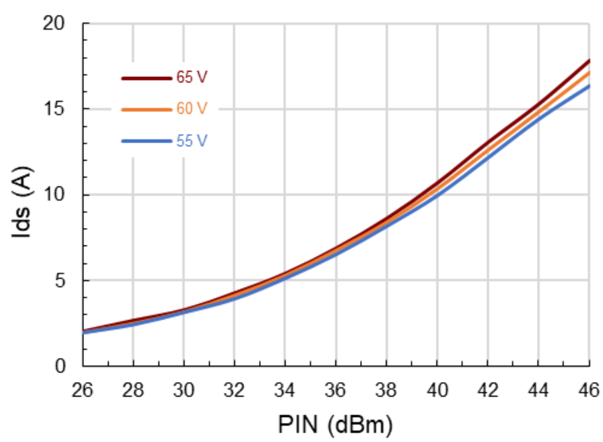
Output Power vs. V_{DS} and P_{IN}



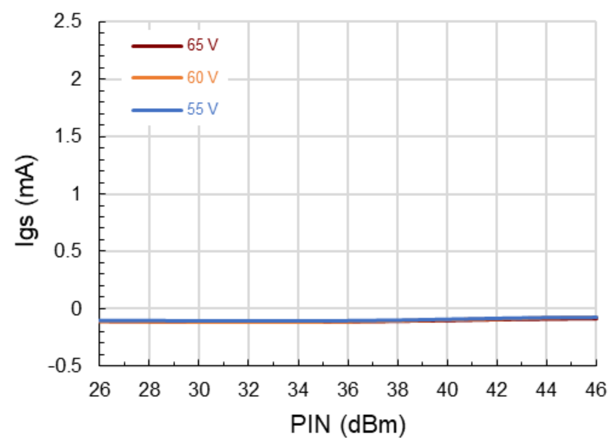
Drain Efficiency vs. V_{DS} and P_{IN}



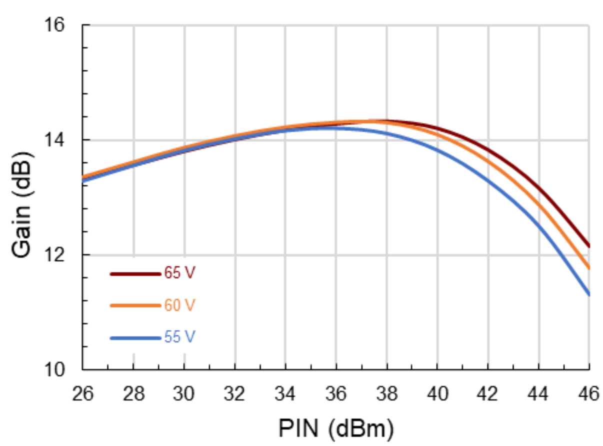
Drain Current vs. V_{DS} and P_{IN}



Gate Current vs. V_{DS} and P_{IN}



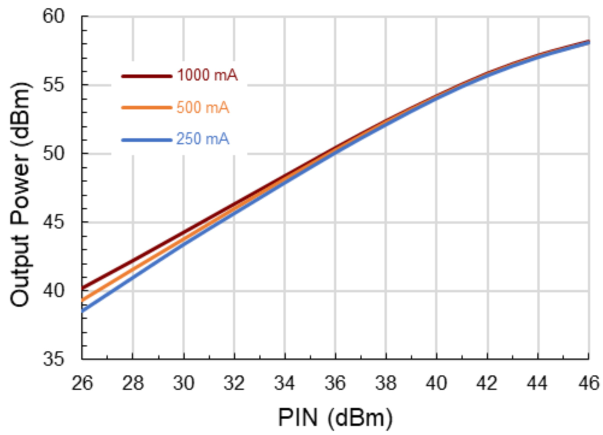
Large Signal Gain vs. V_{DS} and P_{IN}



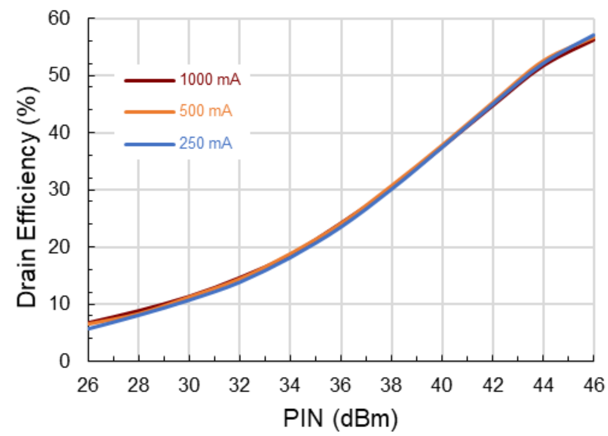
Typical Performance Curves as Measured in the 2.75 – 3.75 GHz Evaluation Test Fixture

Pulsed 100 µs 10%, P_{IN} = 46 dBm, V_{DS} = 65 V, I_{DQ} = 500 mA, Frequency = 3.5 GHz (Unless otherwise noted)
For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

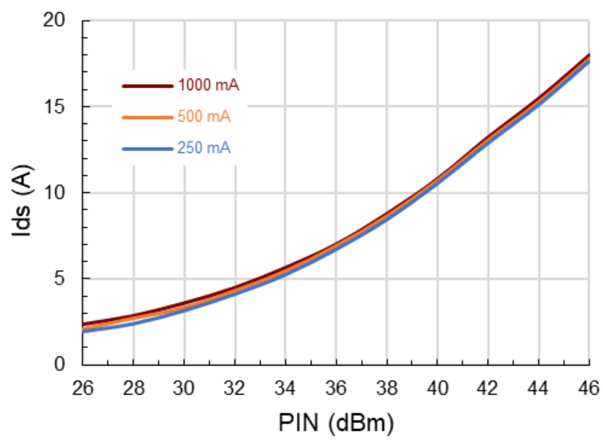
Output Power vs. I_{DQ} and P_{IN}



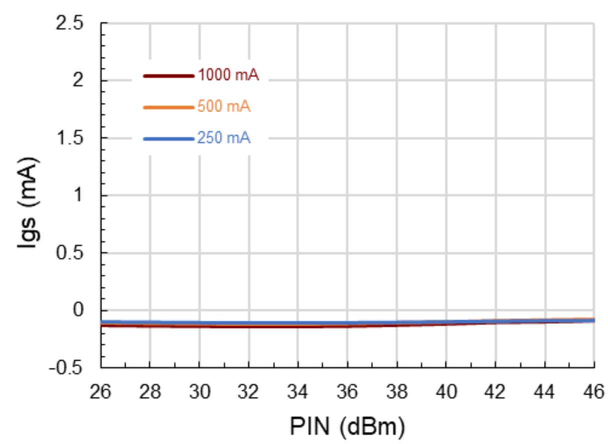
Drain Efficiency vs. I_{DQ} and P_{IN}



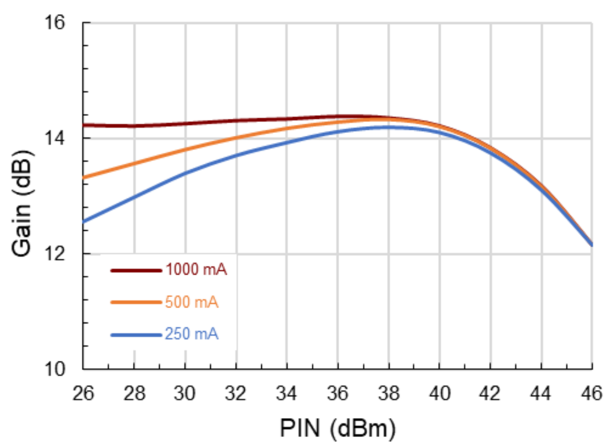
Drain Current vs. I_{DQ} and P_{IN}



Gate Current vs. I_{DQ} and P_{IN}



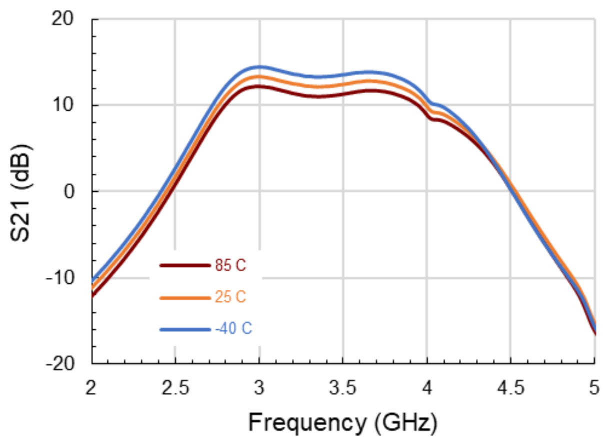
Large Signal Gain vs. I_{DQ} and P_{IN}



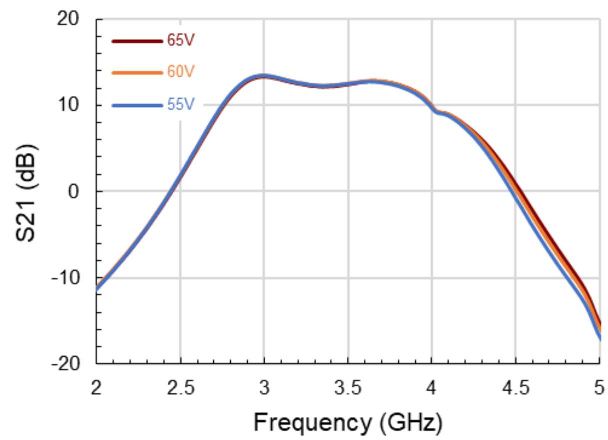
Typical Performance Curves as Measured in the 2.75 – 3.75 GHz Evaluation Test Fixture:

CW, V_{DS} = 65 V, I_{DQ} = 500 mA, P_{IN} = -20 dBm (Unless Otherwise Noted)
For Engineering Evaluation Only—This data does not Modify MACOM's Datasheet Limits.

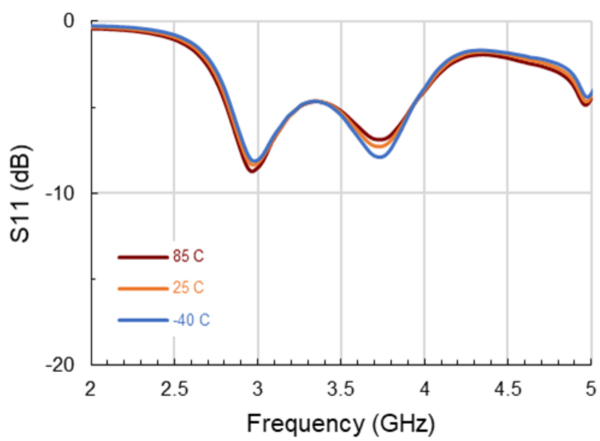
S21 vs Frequency and Temperature



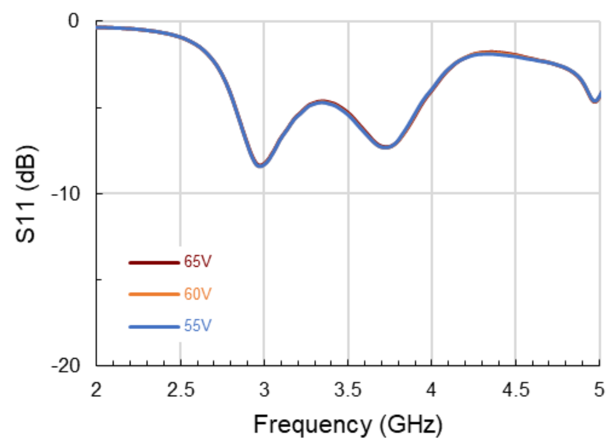
S21 vs Frequency and V_{DS}



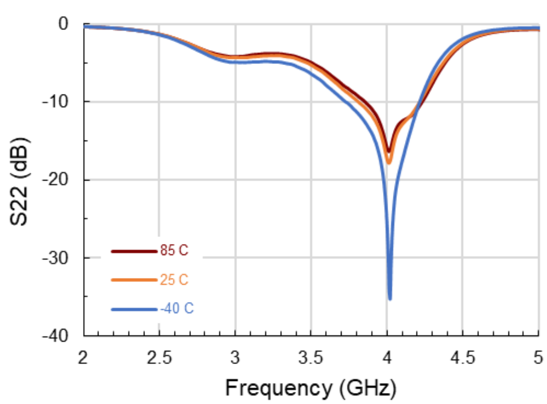
S11 vs Frequency and Temperature



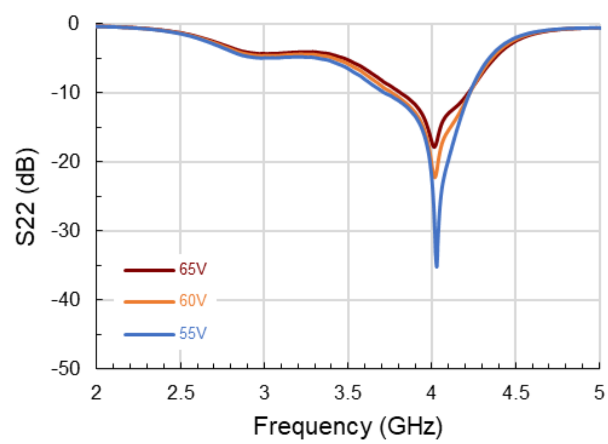
S11 vs Frequency and V_{DS}



S22 vs Frequency and Temperature

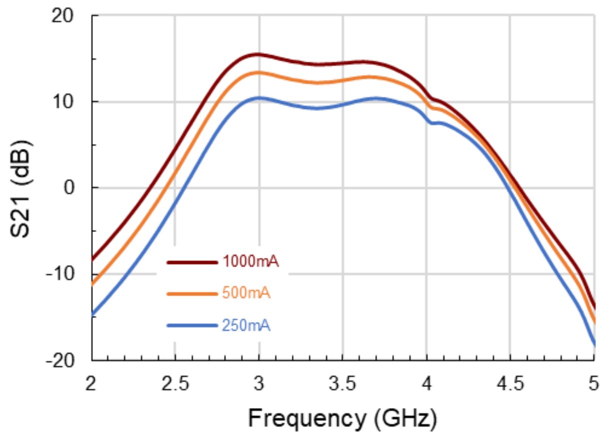


S22 vs Frequency and V_{DS}

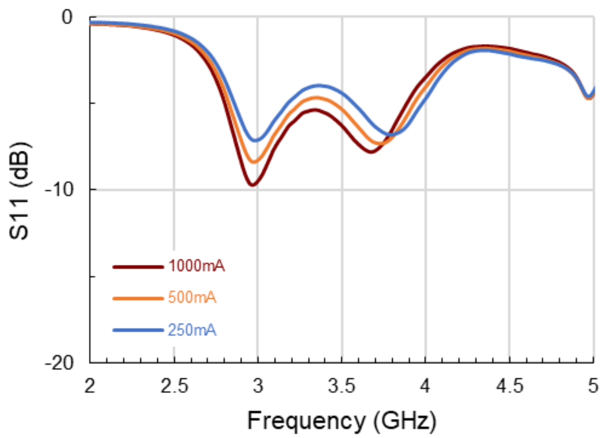


Typical Performance Curves as Measured in the 2.75– 3.75 GHz Evaluation Test Fixture:
CW, V_{DS} = 65 V, I_{DQ} = 500 mA, P_{IN} = -20 dBm (Unless Otherwise Noted)
For Engineering Evaluation Only—This data does not Modify MACOM's Datasheet Limits.

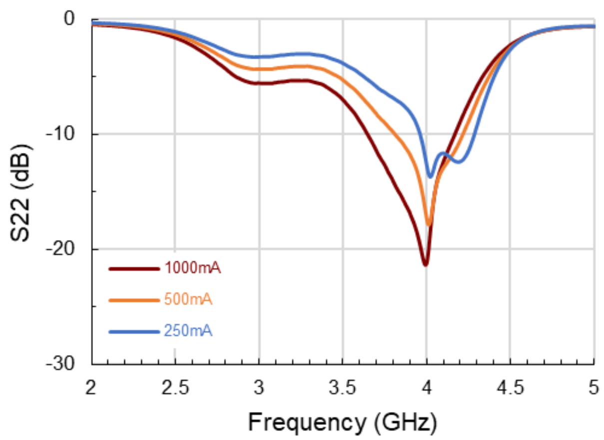
S21 vs Frequency and I_{DQ}



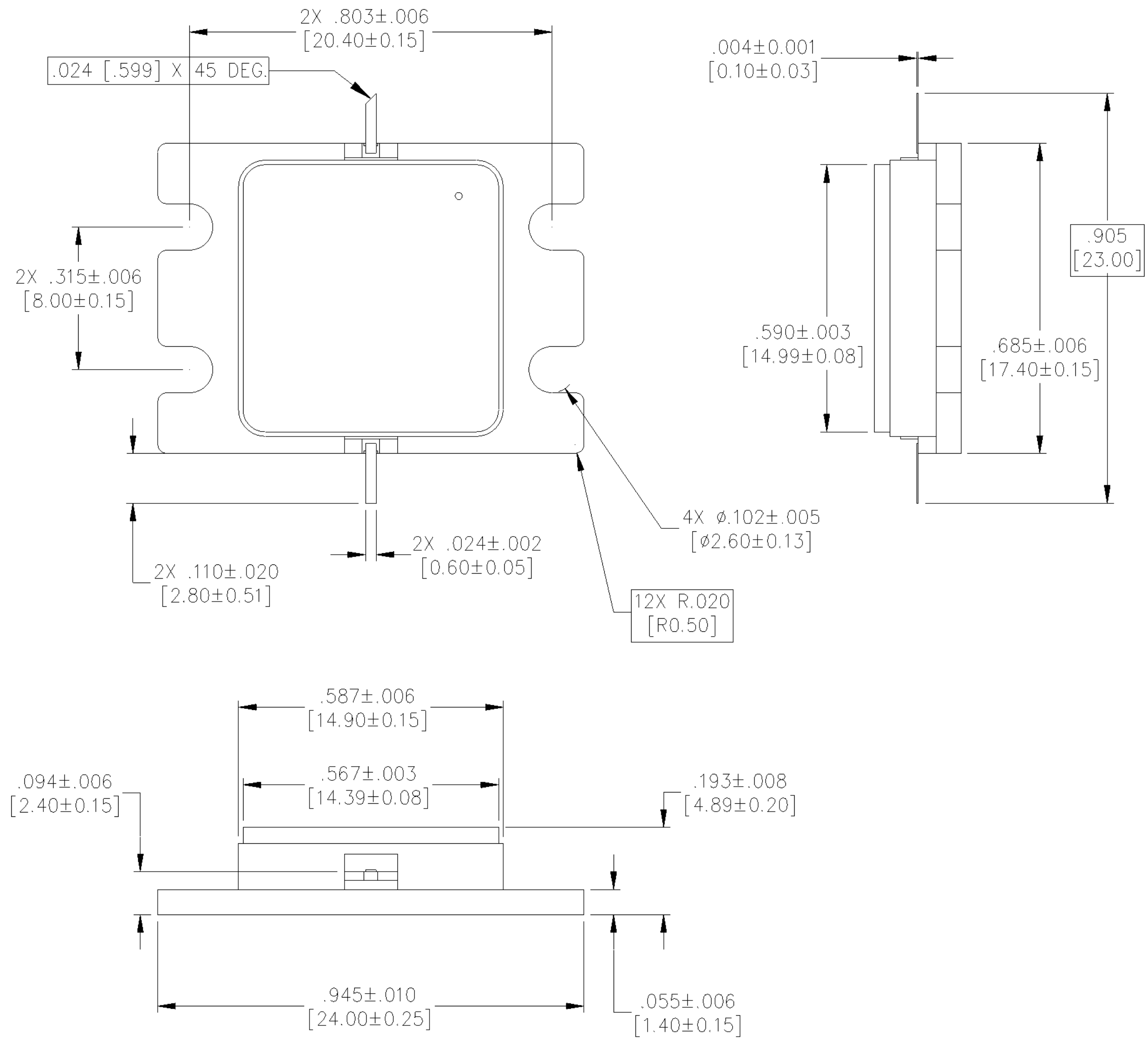
S11 vs Frequency and I_{DQ}



S22 vs Frequency and I_{DQ}



Product Dimensions (Package Type AC–587BH-2)



NOTES:

1. ALL DIMENSIONS SHOWN AS in[mm]. CONTROLLING DIMENSIONS ARE IN in AND CONVERTED mm DIMENSIONS ARE NOT NECESSARILY EXACT.
2. ALL TOLERANCES ARE ±.005 [0.13] UNLESS OTHERWISE NOTED
3. LEAD FINISH: AU
   FLANGE FINISH: AU
   LID MATERIAL: CERAMIC
4. LID SEAL EPOXY MAY FLOW OUT A MAXIMUM OF .020 [0.51] FROM EDGE OF LID
5. LID MAY BE MIS-ALIGNED UP TO .010 [0.25] FROM PACKAGE IN ANY DIRECTION