# GaN on SiC Transistor, 9 W, 28 V
# DC – 8 GHz

MACOM PURE CARBIDE™

**MAPC-A3005-AS**
**Rev. V2**

## Features

- Saturated Power: 9 W
- Drain Efficiency: 55 %
- Small Signal Gain: 14 dB
- Lead-Free Air Cavity Ceramic Package
- RoHS* Compliant

## Applications

- Avionics - TACAN, DME, IFF
- Military Radio
- L, S, C-Band Radar
- Electronic Warfare
- ISM
- General Amplification

## Description

The MAPC-A3005-AS is a 9 W packaged, unmatched transistor utilizing a high performance, 0.15 µm GaN on SiC production process. This transistor supports both defense and commercial related applications.

Offered in a thermally-enhanced flange package, the MAPC-A3005-AS provides superior performance under CW operation allowing customers to improve SWaP-C benchmarks in their next generation systems.

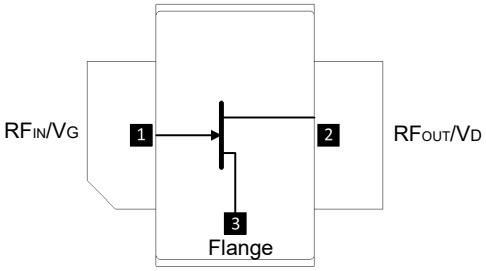
## Typical RF Performance:

- Measured at CW , $P_{IN}$= 30 dBm, $V_{DS}$ = 28 V, $I_{DQ}$ = 100 mA, $T_C$ = 25°C

| Frequency (GHz) | Output Power (dBm) | Gain (dB) | $\eta_D$ (%) |
|---|---|---|---|
| 2 | 40.0 | 10.0 | 68.6 |
| 4 | 40.4 | 10.4 | 58.2 |
| 6 | 39.2 | 9.2 | 52.3 |


**440109**

## Functional Schematic




## Pin Configuration

| Pin # | Pin Name | Function |
|---|---|---|
| 1 | $RF_{IN}$ / $V_G$ | RF Input / Gate |
| 2 | $RF_{OUT}$ / $V_D$ | RF Output / Drain |
| 3 | Flange[3] | 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-A3005-AS000 | Bulk Quantity: Earless |
| MAPC-A3005-ASSB1 | Sample Board : Earless |

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

## Electrical Specifications: Frequency = 2 GHz, $T_A$ = +25°C, $V_{DD}$ = 28 V, $I_{DQ}$ = 100 mA, Low Power Gain tested at Input Power of 10 dBm.

| Parameter | Conditions | Symbol | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Saturated Power | $P_{IN}$ = 30 dBm, CW | $P_{SAT}$ | 8.7 | 9.5 | - | W |
| Drain Efficiency | $P_{IN}$ = 30 dBm, CW | $\eta_{SAT}$ | 59 | 66 | - | % |
| Low Power Gain | $P_{IN}$ = 10 dBm, CW | $G_{SS}$ | 12.0 | 14.5 | - | dB |

Note: Final testing and screening for all transistor sales is performed using the MAPC-A3005-AS-AMP at 2 GHz.

## Absolute Maximum Ratings[2,3]

| Parameter | Absolute Maximum |
|---|---|
| Drain-Source Voltage | 84 V |
| Gate Voltage | -10, +2 V |
| Drain Current | 0.75 A |
| Gate Current | 2.16 mA |
| Input Power | 31 dBm |
| Storage Temperature | -55°C to +150°C |
| Mounting Temperature | +245°C |
| Junction Temperature[3,4,5] | +225°C |
| Operating Temperature | -40°C to +85°C |

2. Exceeding any one or combination of these limits may cause permanent damage to this device.
3. MACOM does not recommend sustained operation near these survivability limits.
4. Operating at nominal conditions with $T_J \leq$ +225 °C will ensure MTTF > 1 x $10^6$ hours.
5. Junction Temperature ($T_J$) = $T_C$ + Θjc * (V * I)
   Typical thermal resistance (Θjc) = 9.5 °C/W for CW.
   a) For $T_C$ = +25°C,
   $T_J$ = 78 °C @ $P_{DISS}$ = 5.6 W
   b) For $T_C$ = +85°C,
   $T_J$ = 137 °C @ $P_{DISS}$ = 5.4 W

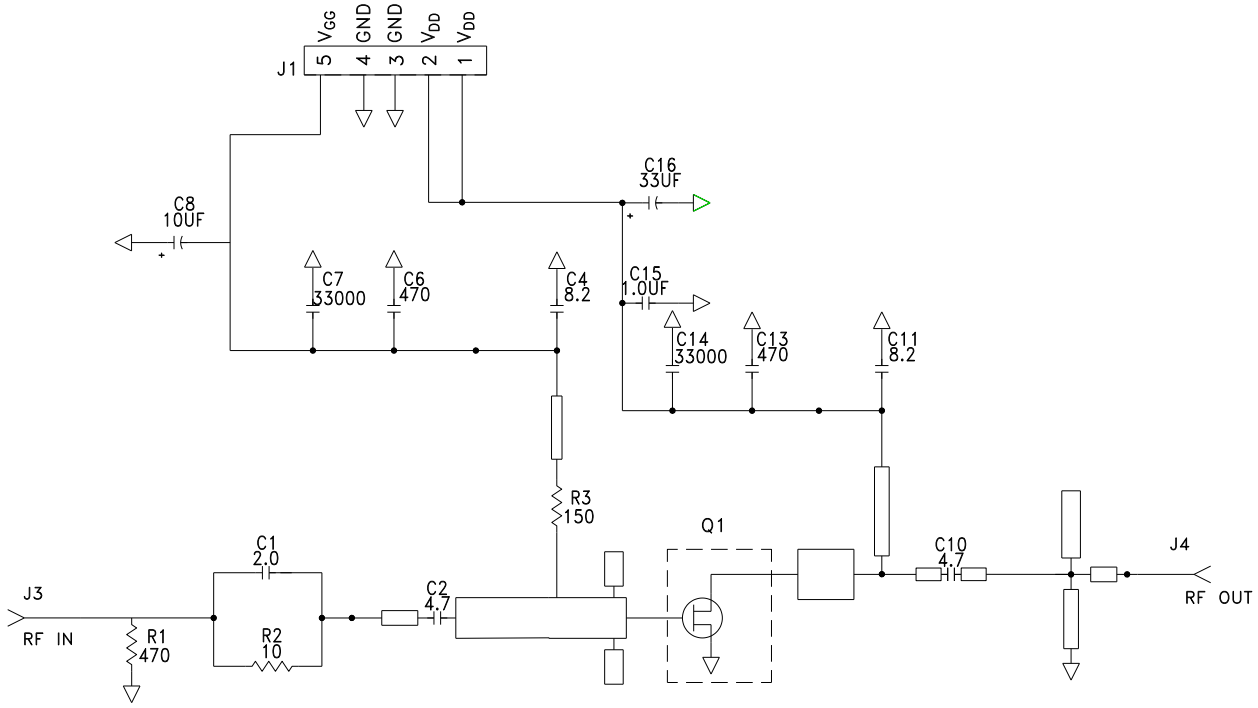
## Handling Procedures

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 devices.

## Evaluation Test Fixture and Recommended Tuning Solution, 2 GHz




## Biasing Sequence

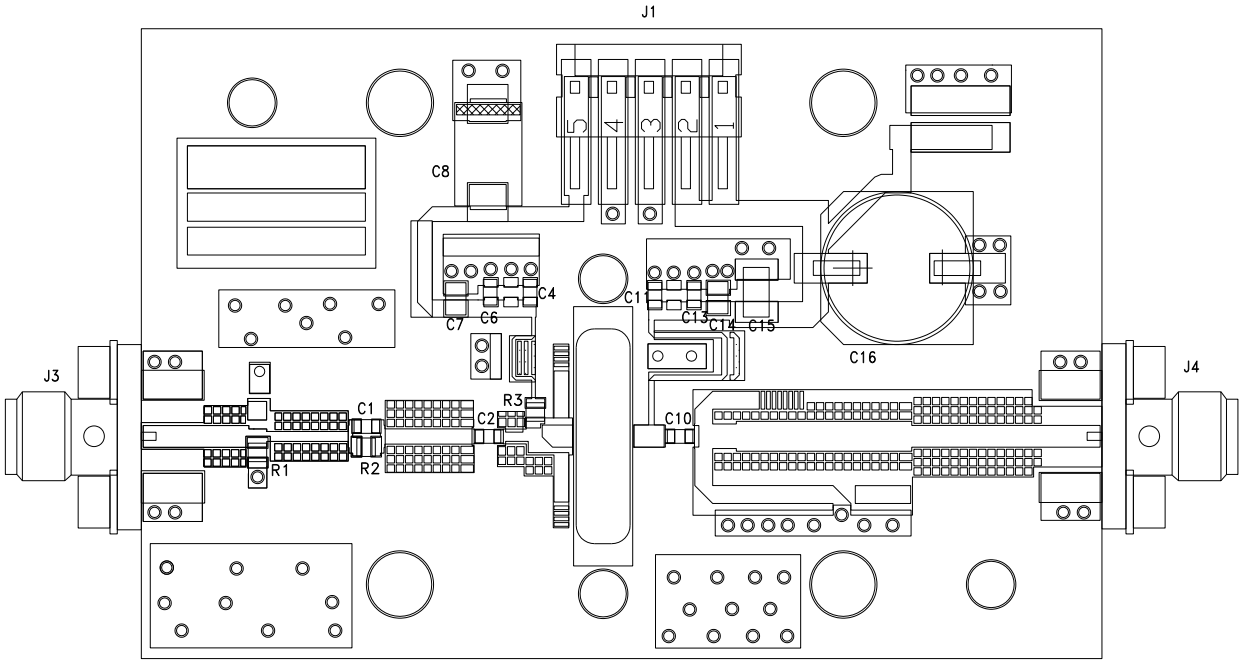
**Bias ON**

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

## Evaluation Test Fixture and Recommended Tuning Solution, 2 GHz



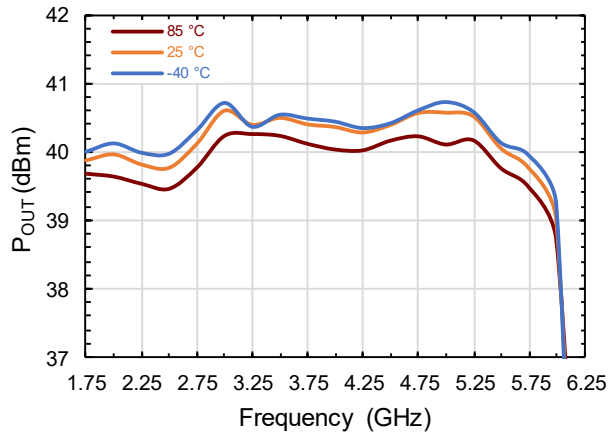

## Assembly Parts List

| Designator | Description | Qty. |
|---|---|---|
| C1 | CAP, 2 pF, +/-0.1, 250V, 0603, 125C, ATC 600S | 1 |
| C2, C10 | CAP, 4.7 pF, +/-0.1, 250V, 0603, 125C, ATC 600S | 2 |
| C4, C11 | CAP, 8.2 pF, +/-0.1, 250V, 0603, 125C, ATC 600S | 2 |
| C6, C13 | CAP, 470 pF, +/-T5%, 0603in, 100V, 125c Murata | 2 |
| C7, C14 | CAP, 0.033 µF, +/-T10%, 100V, 0805in, 125C Murata | 2 |
| C8 | CAP, 10 µF, +/-T20%, 16V, 2312in, 125C, AVX | 1 |
| C15 | CAP, 1 µF, +/-T10%, 63V, 1210in, 125C, Murata | 1 |
| C16 | CAP, 33 µF, +/-T20%, 100V, CAN-SMD, 105C, Panasonic | 1 |
| R1 | RES, 25 W, 0505, 5%, 470 Ω, 150C | 1 |
| R2 | RES, 25 W, 0505, 5%, 10 Ω, 150C | 1 |
| R3 | RES, 25 W, 0505, 5%, 150 Ω, 150C | 1 |
| J1 | HEADER RT>PLZ .1CEN LK 5POS | 1 |
| J3,J4 | CONNECTOR; SMB, Straight, JACK, SMD | 2 |
| - | PCB, RO5880, Er = 2.20, H = 20 mil | 1 |
| Q1 | MAPC-A3005-AS | 1 |

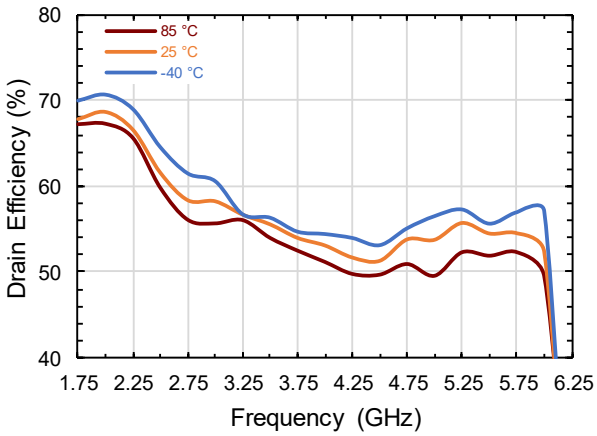
## Typical Performance Curves as Measured in the 2 - 6 GHz Evaluation Test Fixture

CW, $P_{IN}$ = 30 dBm, $V_{DS}$ = 28 V, $I_{DQ}$ = 100 mA. Frequency = 4 GHz (unless otherwise noted)
For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

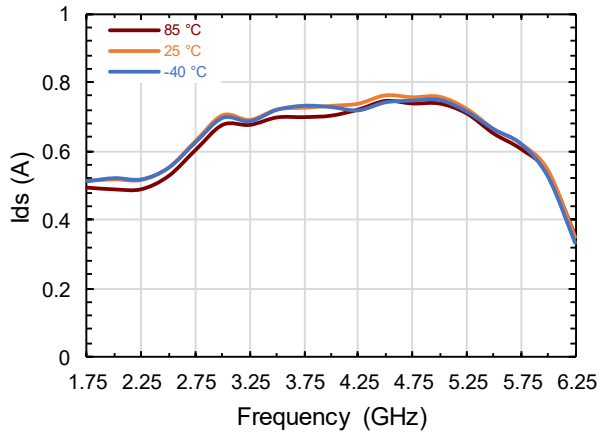
***Output Power vs. Temperature and Frequency***



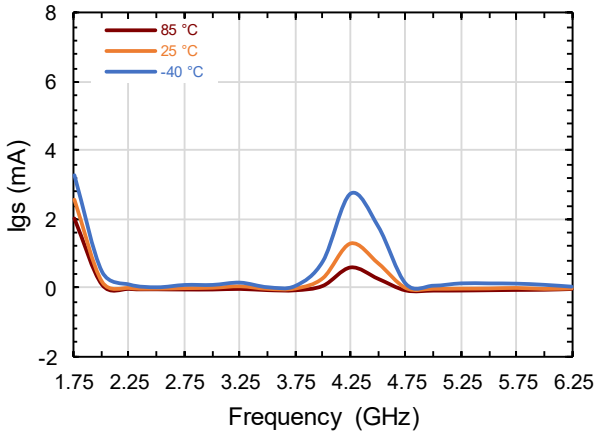

***Drain Efficiency vs. Temperature and Frequency***



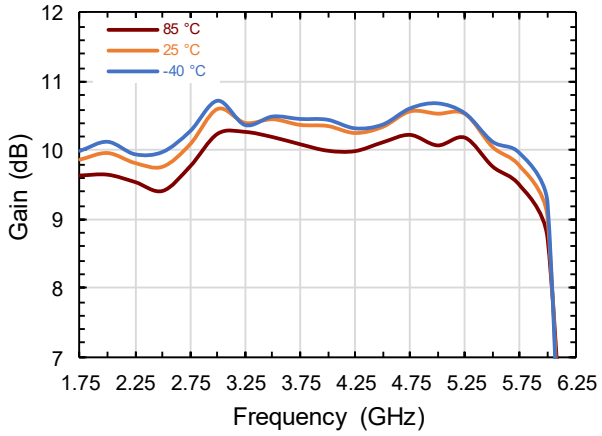

***Drain Current vs. Temperature and Frequency***




***Gate Current vs. Temperature and Frequency***




***Large Signal Gain vs. Temperature and Frequency***



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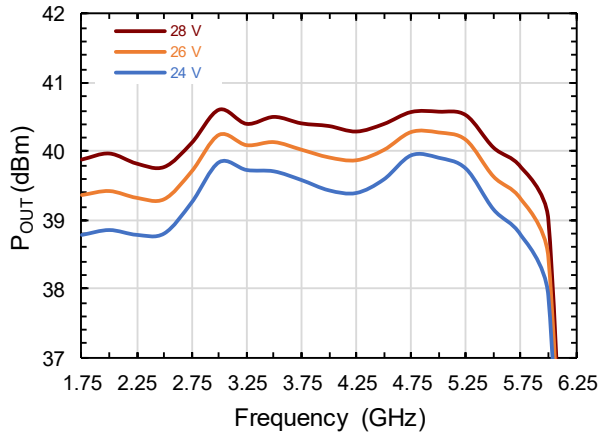


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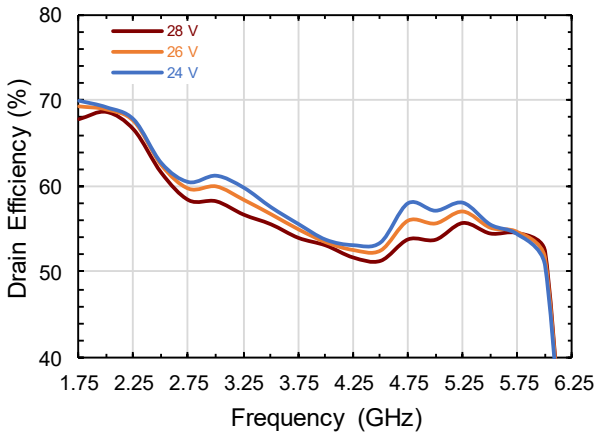


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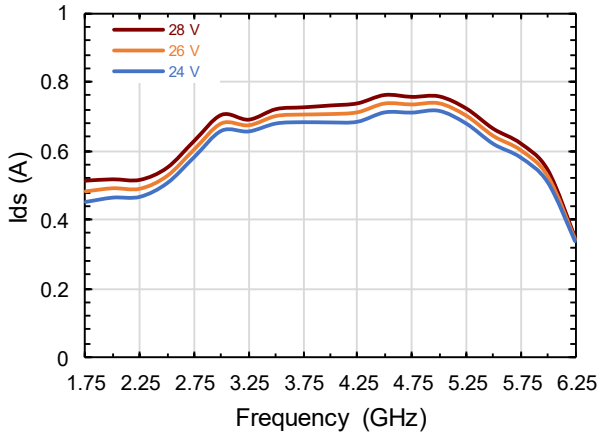
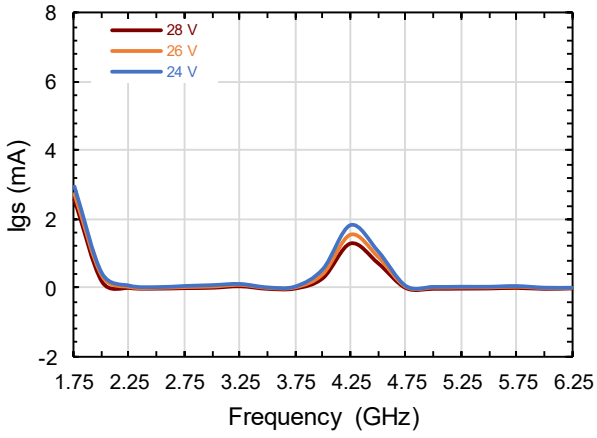



***Gate Current vs. $V_{DS}$ and Frequency***

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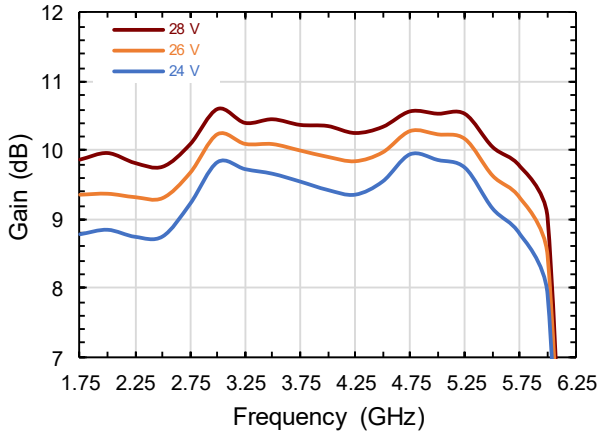

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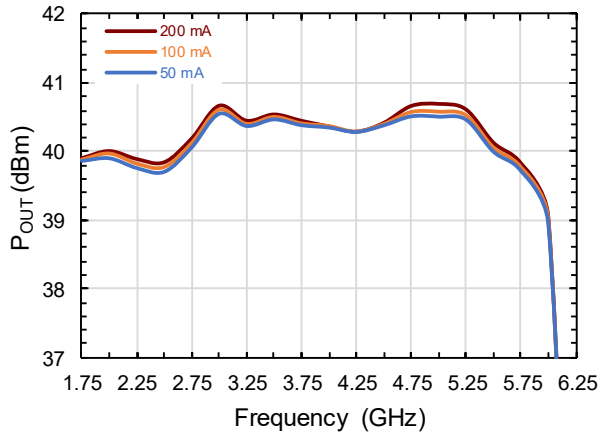
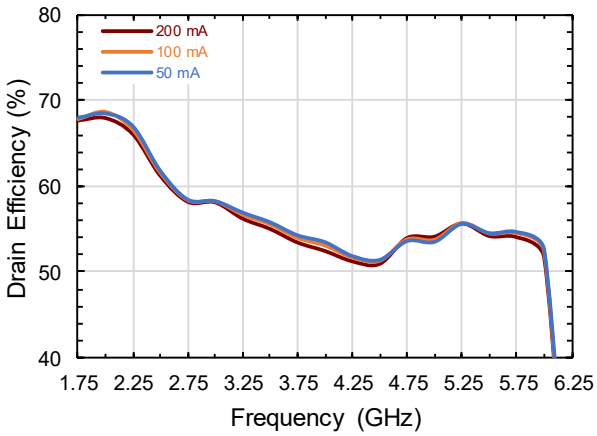



***Drain Efficiency vs. $I_{DQ}$ and Frequency***

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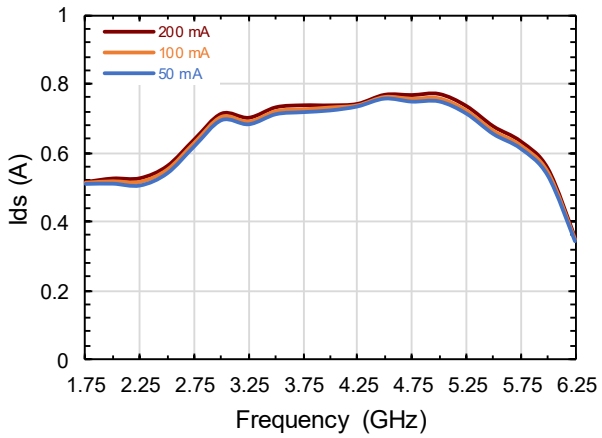
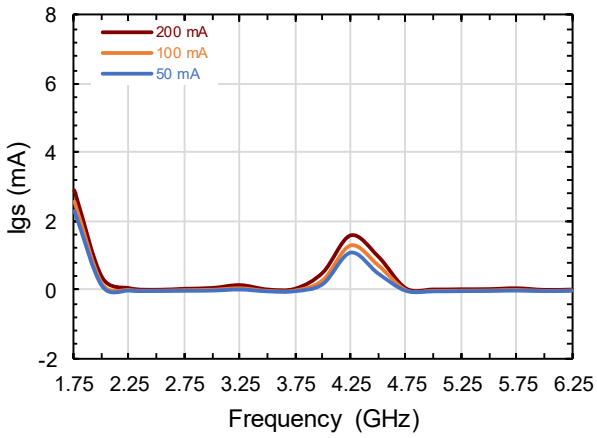



***Gate Current vs. $I_{DQ}$ and Frequency***

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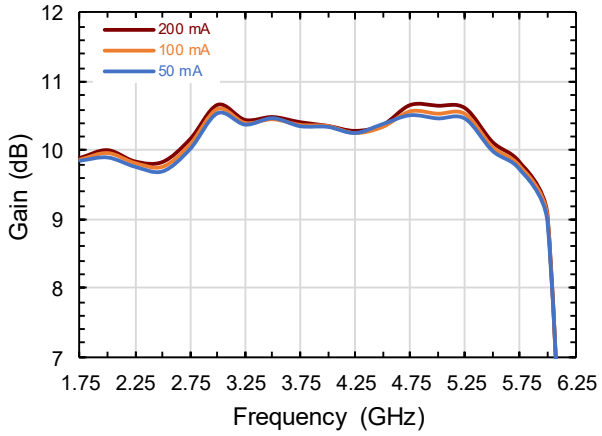

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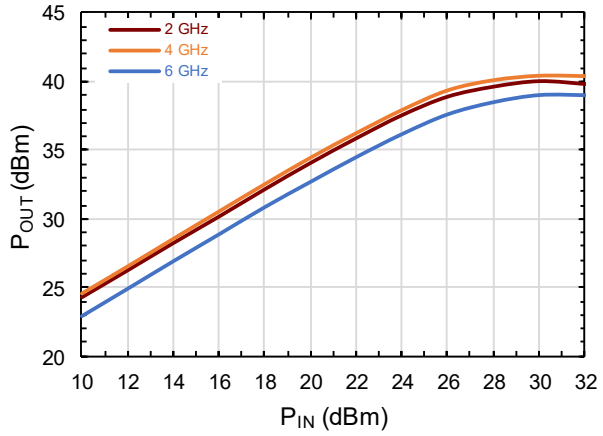
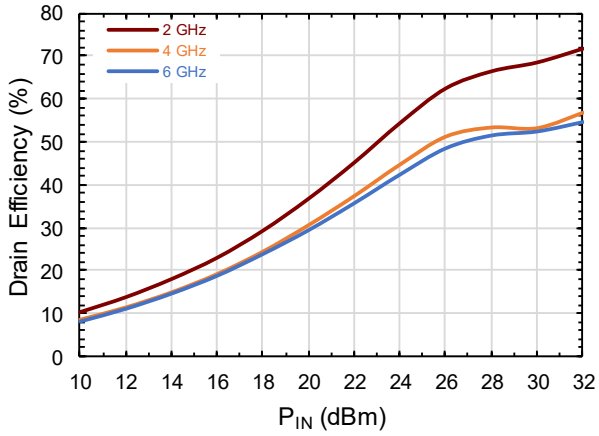
***Output Power vs. Frequency and $P_{IN}$***




***Drain Efficiency vs. Frequency and $P_{IN}$***

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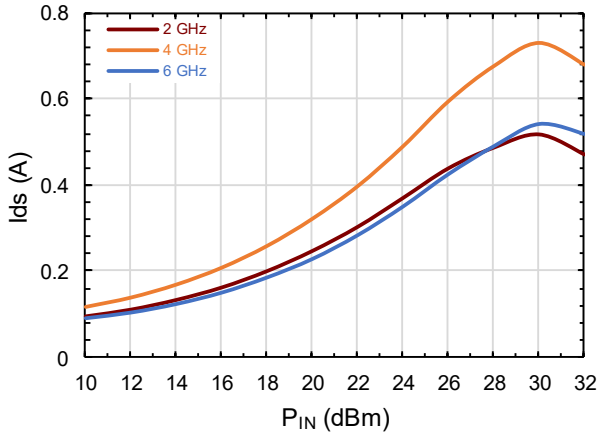
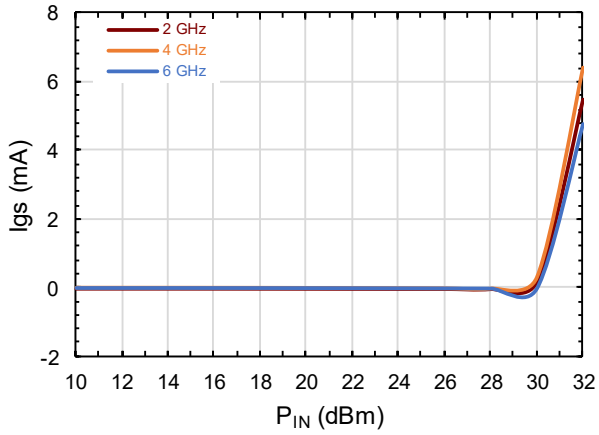
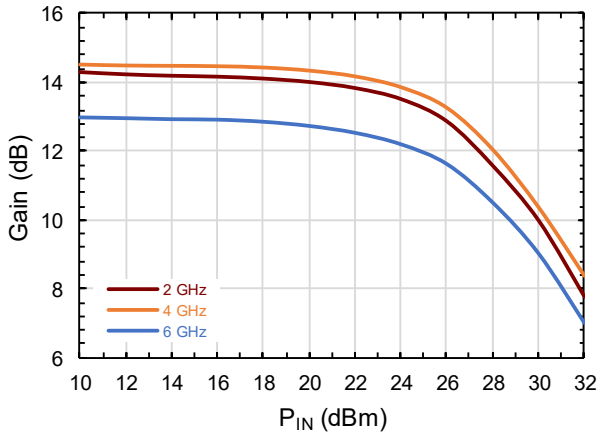



***Gate Current vs. Frequency and $P_{IN}$***




***Large Signal Gain vs. Frequency and $P_{IN}$***



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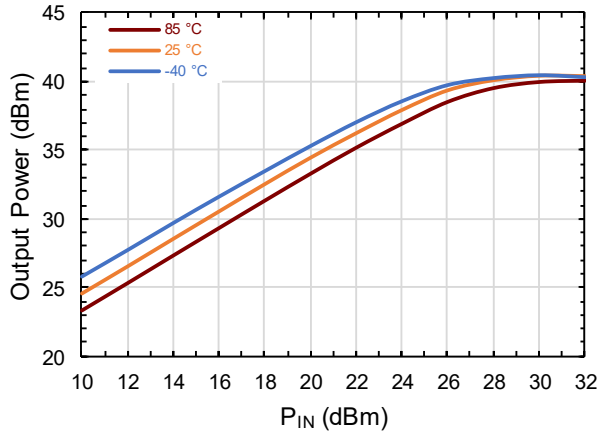
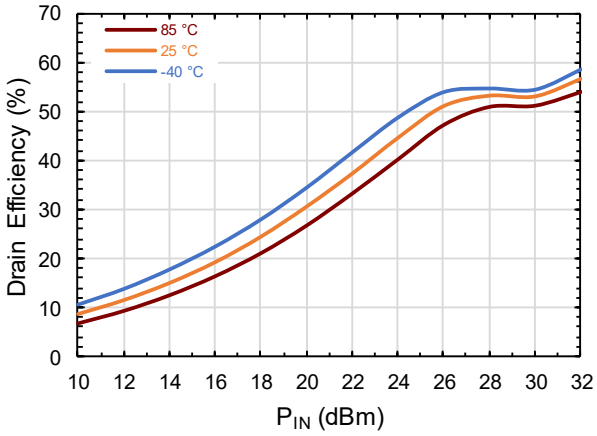



***Drain Efficiency vs. Temperature and $P_{IN}$***

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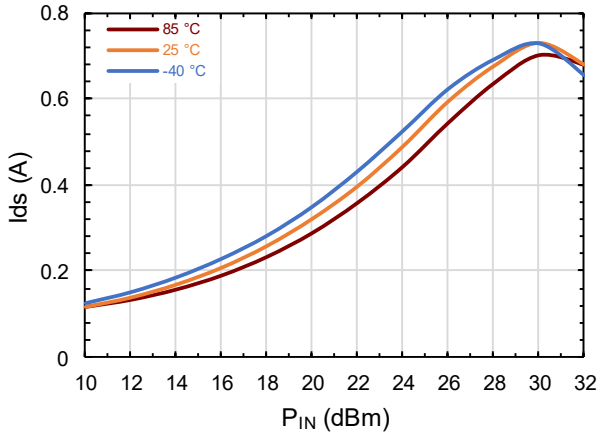
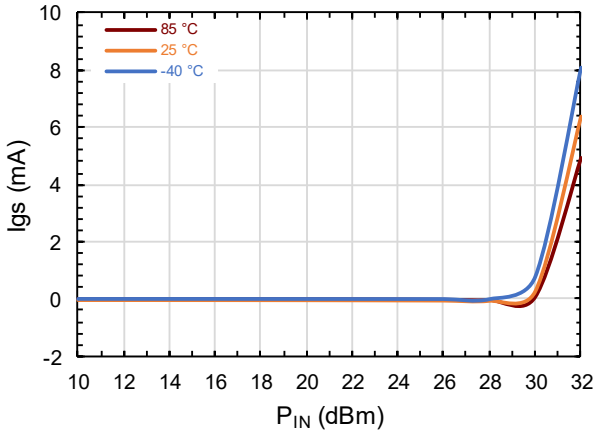
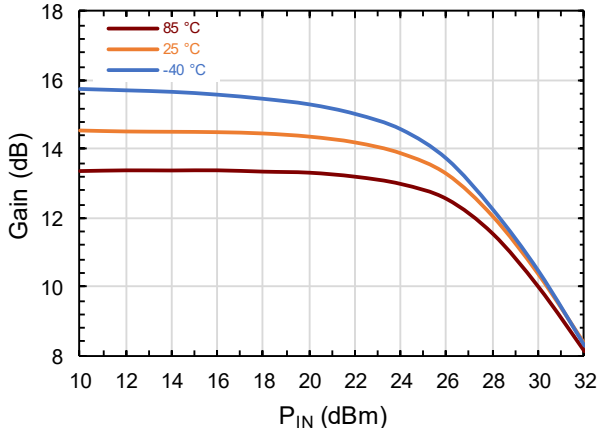



***Gate Current vs. Temperature and $P_{IN}$***




***Large Signal Gain vs. Temperature and $P_{IN}$***



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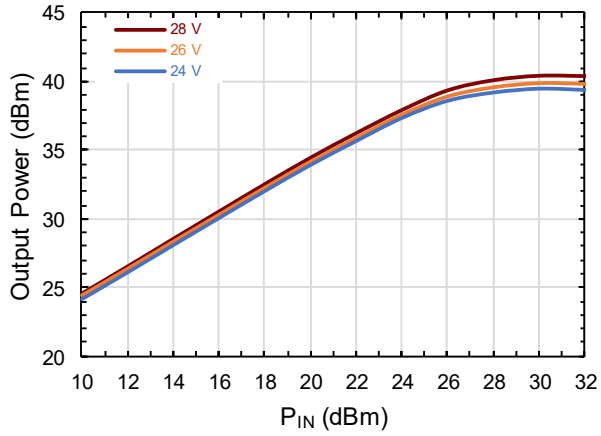
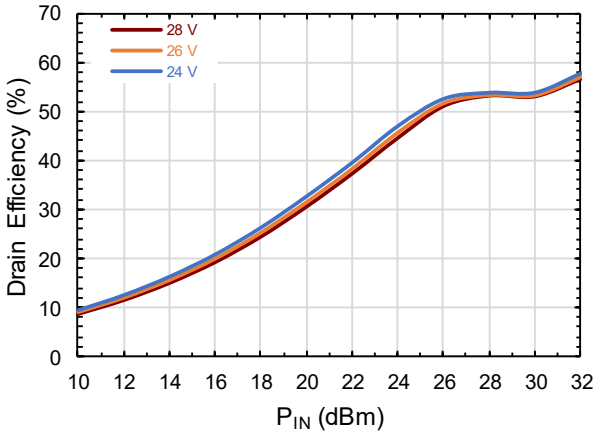
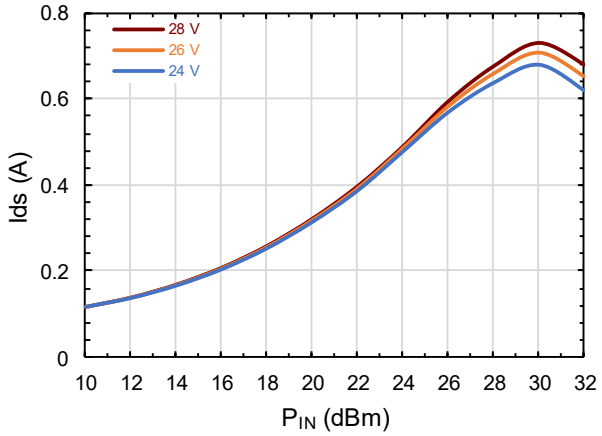


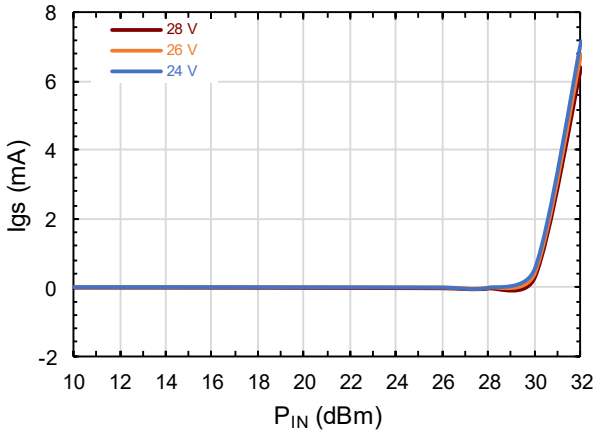

***Drain Efficiency vs. $V_{DS}$ and $P_{IN}$***



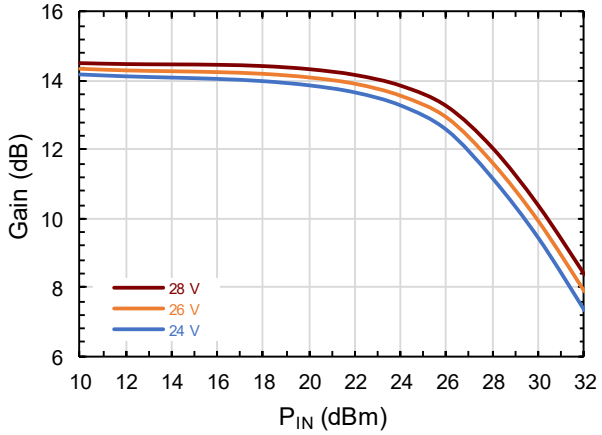

***Drain Current vs. $V_{DS}$ and $P_{IN}$***




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




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



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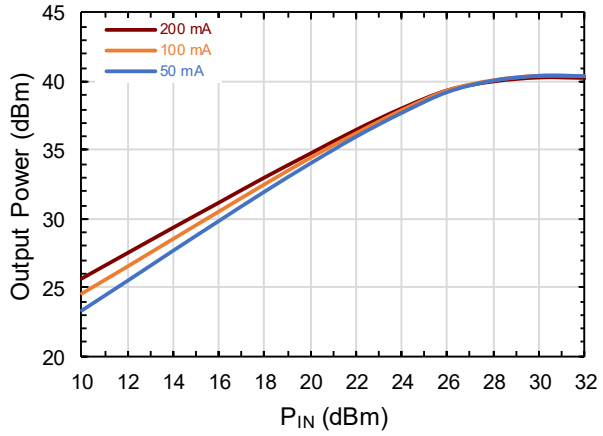
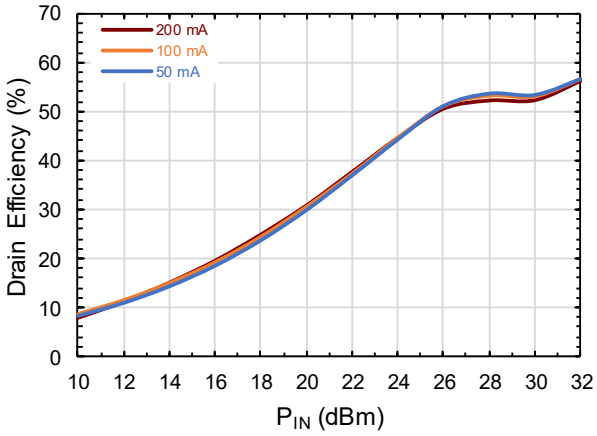
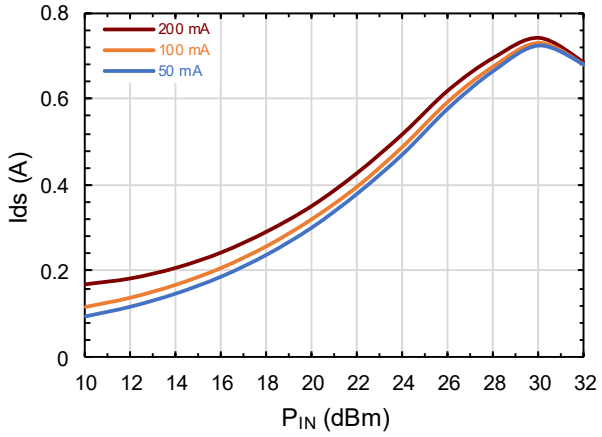
***Output Power vs. $I_{DQ}$ and $P_{IN}$***




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




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

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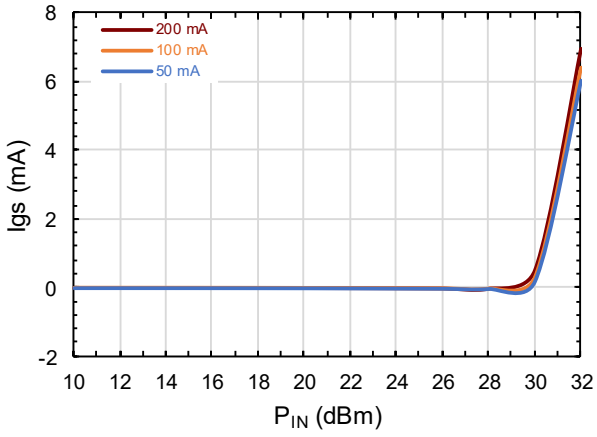


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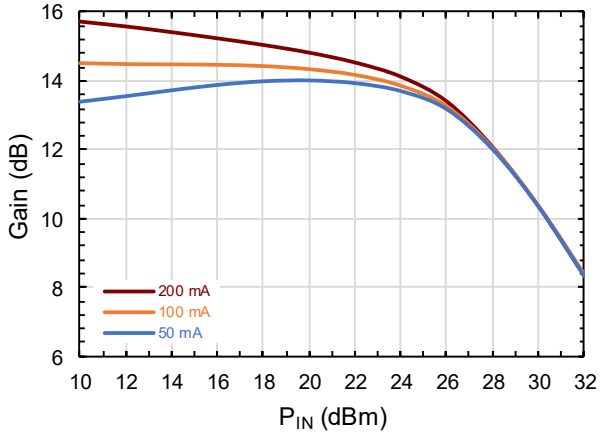
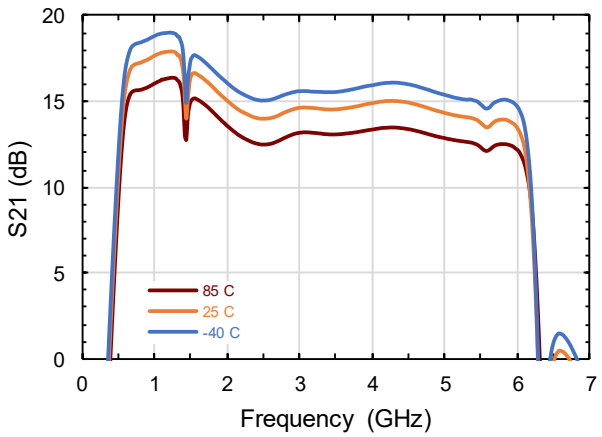


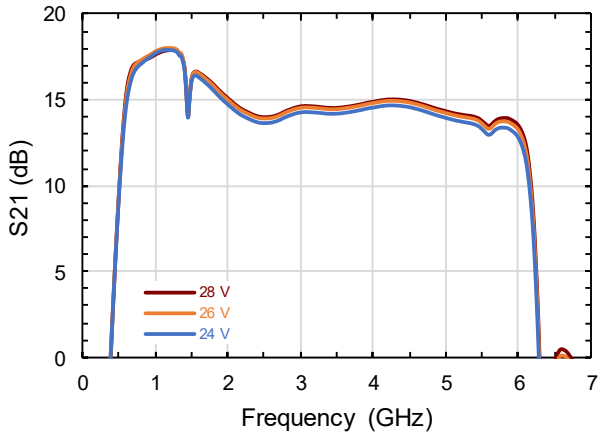
## Typical Performance Curves as Measured in the 2 - 6 GHz Evaluation Test Fixture:

CW, $V_{DS}$ = 28 V, $I_{DQ}$ = 100 mA, $P_{IN}$ = -20 dBm (Unless Otherwise Noted)
For Engineering Evaluation Only—This data does not Modify MACOM's Datasheet Limits.

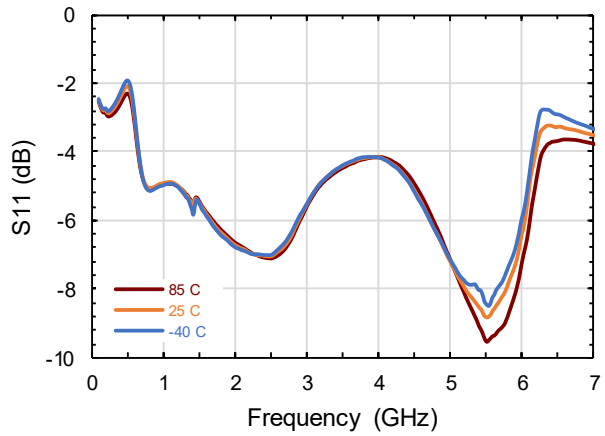
***S21 vs Frequency and Temperature***



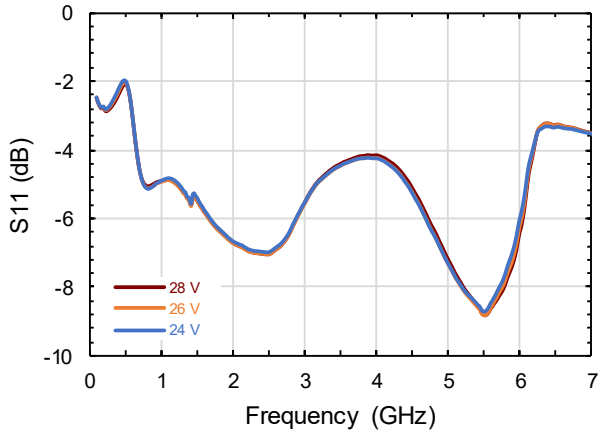

***S21 vs Frequency and $V_{DS}$***



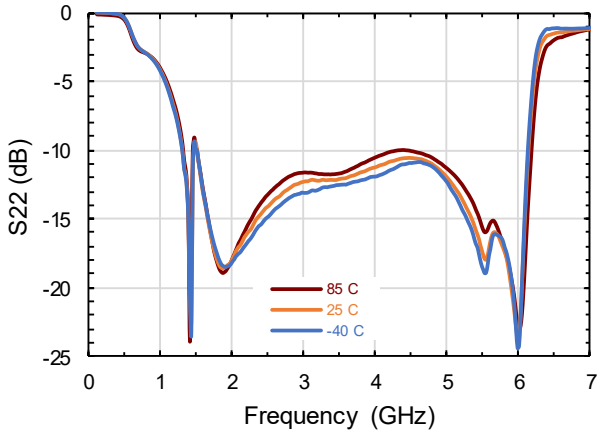

***S11 vs Frequency and Temperature***



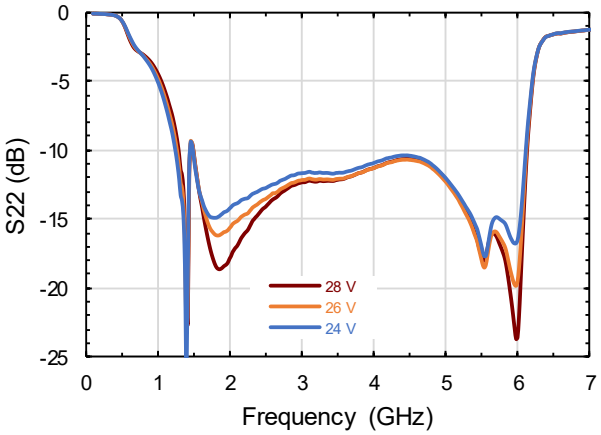

***S11 vs Frequency and $V_{DS}$***




***S22 vs Frequency and Temperature***



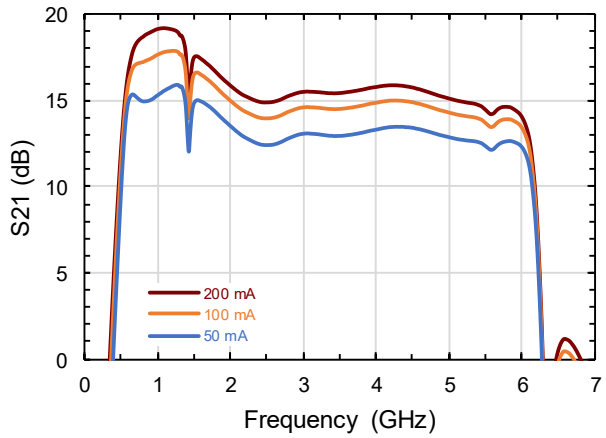

***S22 vs Frequency and $V_{DS}$***



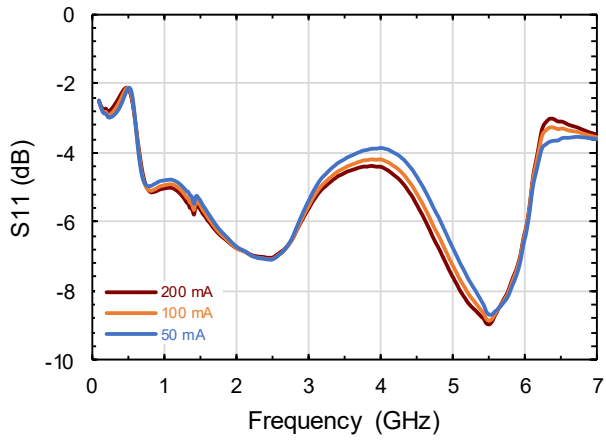
## Typical Performance Curves as Measured in the 2 - 6 GHz Evaluation Test Fixture:

CW, $V_{DS}$ = 28 V, $I_{DQ}$ = 100 mA, $P_{IN}$ = -20 dBm (Unless Otherwise Noted)
For Engineering Evaluation Only—This data does not Modify MACOM's Datasheet Limits.

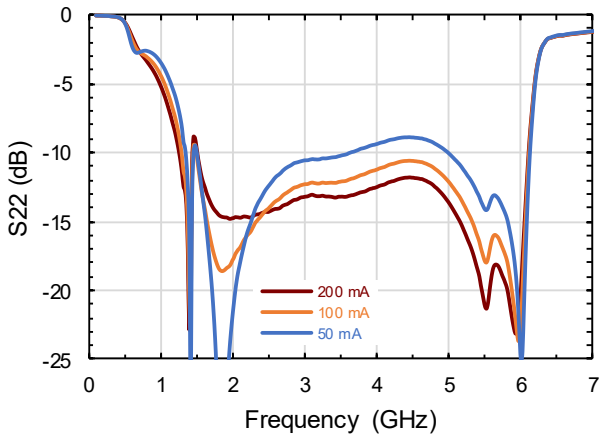
***S21 vs Frequency and $I_{DQ}$***



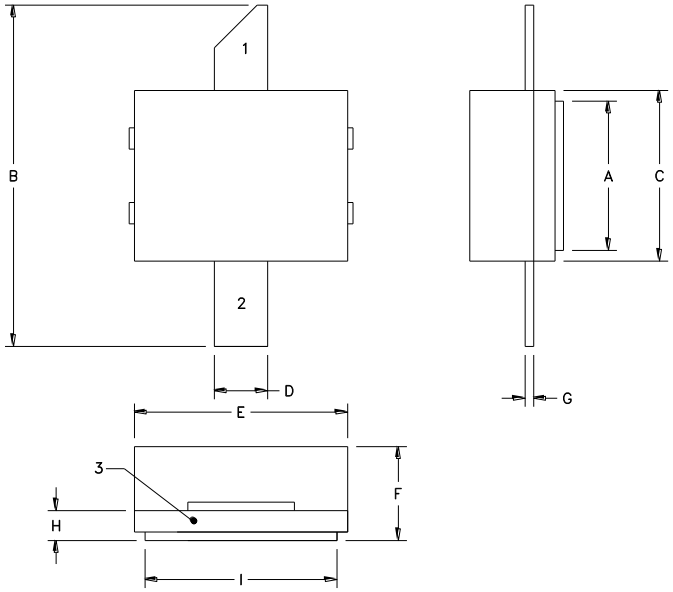

***S11 vs Frequency and $I_{DQ}$***




***S22 vs Frequency and $I_{DQ}$***



## Lead-free 440109 Package Dimensions




NOTES: (UNLESS OTHERWISE SPECIFIED)

1. INTERPRET DRAWING IN ACCORDANCE WITH ANSI Y14.5M–1982 DIMENSIONING AND TOLERANCING.
2. CONTROLLING DIMENSION: INCH.
3. ALL PLATED SURFACES ARE Ni/Au

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | .135 | .145 | 3.43 | 3.68 |
| B | .315 | .325 | 8.00 | 8.26 |
| C | .155 | .165 | 3.94 | 4.19 |
| D | .045 | .055 | 1.14 | 1.40 |
| E | .195 | .205 | 4.95 | 5.21 |
| F | .085 | .104 | 2.15 | 2.65 |
| G | .007 | .009 | .178 | 0.23 |
| H | .026 | .030 | .660 | .762 |
| I | .175 | .185 | 4.45 | 4.70 |

PIN 1. GATE
PIN 2. DRAIN
PIN 3. SOURCE

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