

Rev. V2

## MACOM PURE CARBIDE...

#### **Features**

Saturated Power: 9 WDrain 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:**

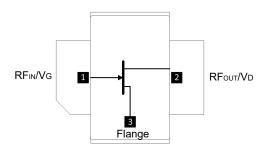
• Measured at CW ,  $P_{IN}$ = 30 dBm,  $V_{DS}$  = 28 V,  $I_{DQ}$  = 100 mA,  $T_{C}$  = 25°C

| Frequency<br>(GHz) | Output Power Gain (dBm) (dB) |      | η <sub>□</sub><br>(%) |
|--------------------|------------------------------|------|-----------------------|
| 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 <sub>IN</sub> / V <sub>G</sub>  | RF Input / Gate   |
| 2    | RF <sub>OUT</sub> / V <sub>D</sub> | RF Output / Drain |
| 3    | Flange <sup>3</sup>                | Ground / Source   |

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 |  |

<sup>\*</sup> Restrictions on Hazardous Substances, compliant to current RoHS EU directive.



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# 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. | Тур. | Max. | Units |
|------------------|------------------------------|------------------|------|------|------|-------|
| Saturated Power  | P <sub>IN</sub> = 30 dBm, CW | P <sub>SAT</sub> | 8.7  | 9.5  | -    | W     |
| Drain Efficiency | P <sub>IN</sub> = 30 dBm, CW | η <sub>SAT</sub> | 59   | 66   | -    | %     |
| Low Power Gain   | P <sub>IN</sub> = 10 dBm, CW | Gss              | 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<sup>2,3</sup>**

| 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 <sup>3,4,5</sup> | +225°C           |  |
| Operating Temperature                 | -40°C to +85°C   |  |

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

#### **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.

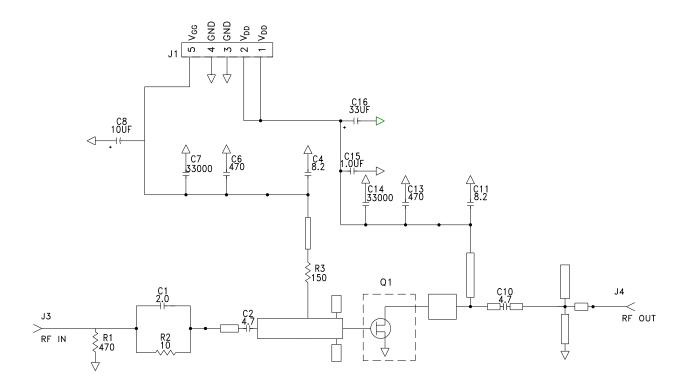
T<sub>J</sub> = 137 °C @ P<sub>DISS</sub> = 5.4 W



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## **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

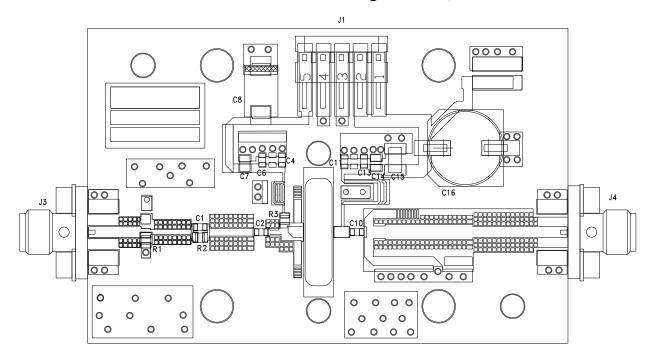
#### **Bias OFF**

- 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



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## **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    |



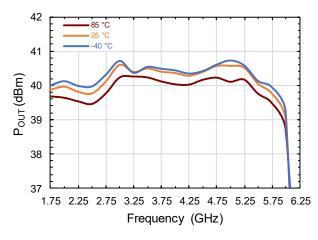
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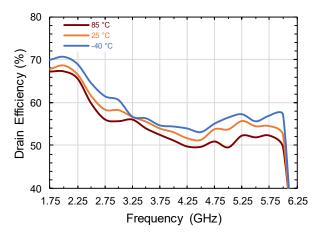
## Typical Performance Curves as Measured in the 2 - 6 GHz Evaluation Test Fixture

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.

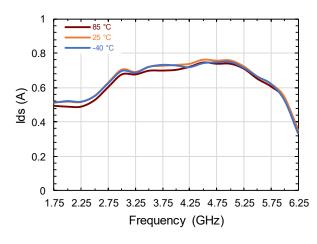
#### Output Power vs. Temperature and Frequency



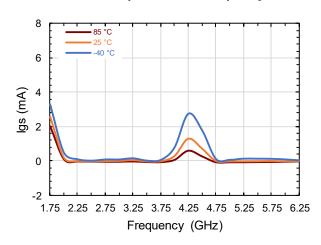
#### Drain Efficiency vs. Temperature and Frequency



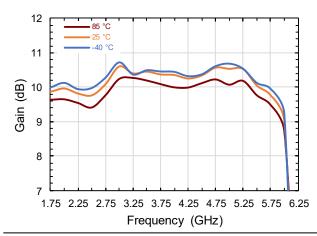
#### Drain Current vs. Temperature and Frequency



Gate Current vs. Temperature and Frequency



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



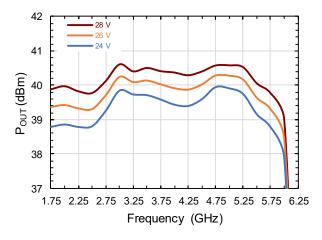


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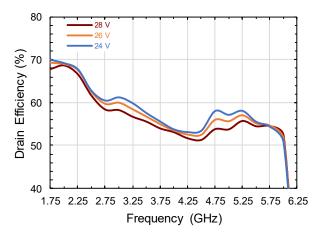
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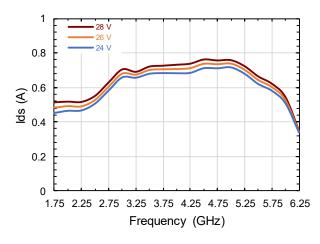
#### Output Power vs. V<sub>DS</sub> and Frequency



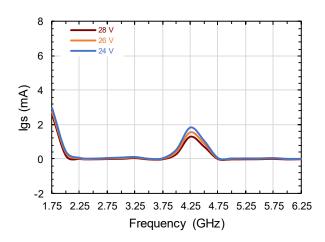
#### Drain Efficiency vs. V<sub>DS</sub> and Frequency



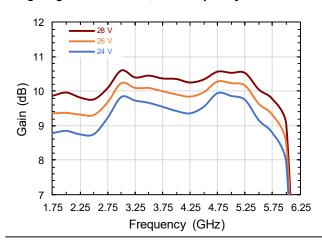
#### Drain Current vs. VDS and Frequency



Gate Current vs. V<sub>DS</sub> and Frequency



#### Large Signal Gain vs. VDS and Frequency





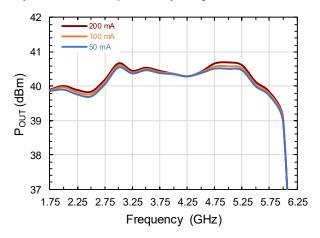
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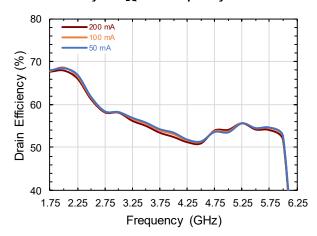
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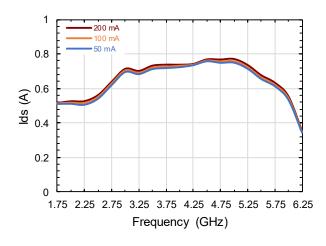
#### Output Power vs. IDQ and Frequency



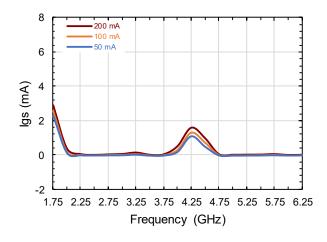
#### Drain Efficiency vs. I<sub>DQ</sub> and Frequency



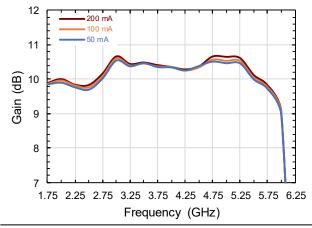
#### Drain Current vs. IDQ and Frequency



Gate Current vs. IDO and Frequency



#### Large Signal Gain vs. $I_{DQ}$ and Frequency



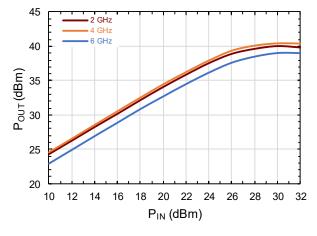


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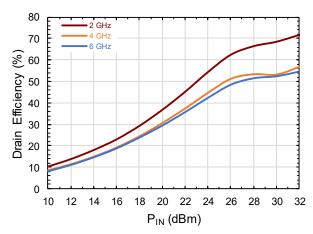
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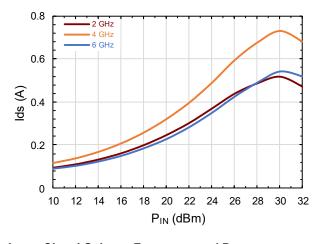
#### Output Power vs. Frequency and PIN



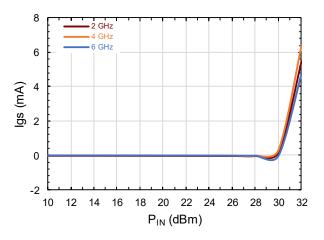
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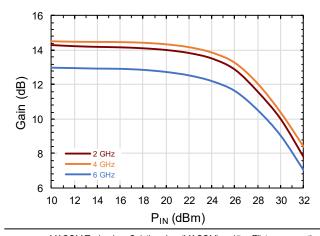
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Gate Current vs. Frequency and PIN



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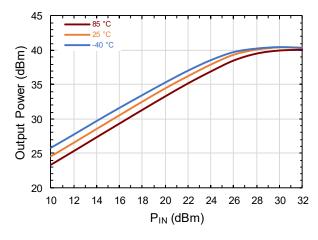


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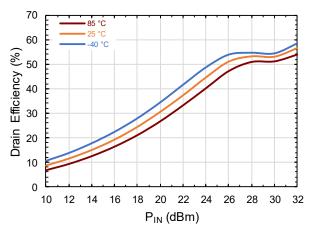
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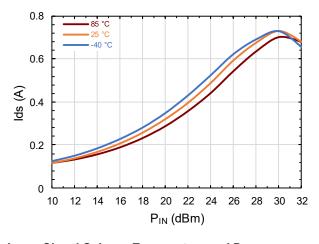
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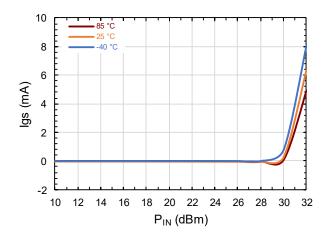
#### Drain Efficiency vs. Temperature and P<sub>IN</sub>



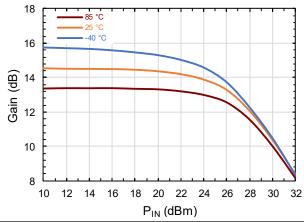
#### Drain Current vs. Temperature and PIN



Gate Current vs. Temperature and PIN



#### Large Signal Gain vs. Temperature and $P_{\text{IN}}$



9

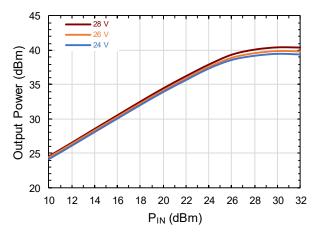


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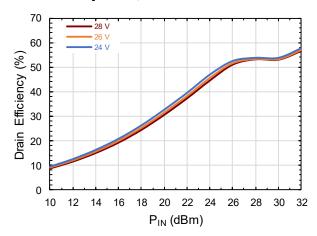
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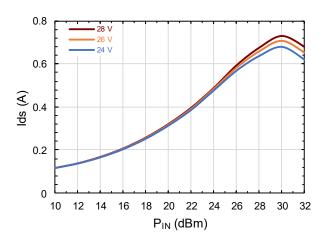
#### Output Power vs. VDS and PIN



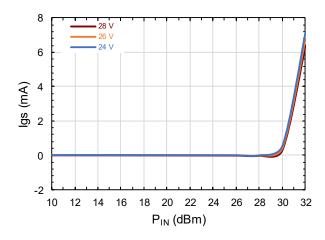
#### Drain Efficiency vs. V<sub>DS</sub> and P<sub>IN</sub>



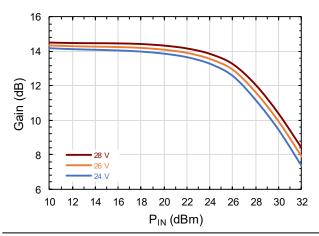
#### Drain Current vs. V<sub>DS</sub> and P<sub>IN</sub>



Gate Current vs. V<sub>DS</sub> and P<sub>IN</sub>



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





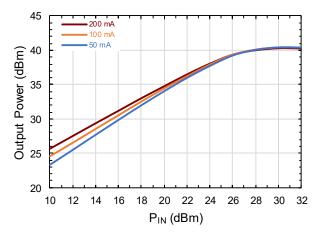
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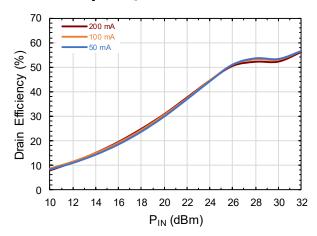
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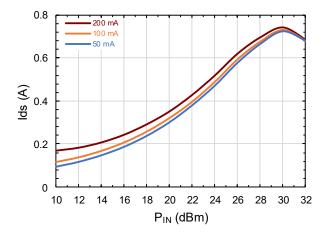
#### Output Power vs. IDQ and PIN



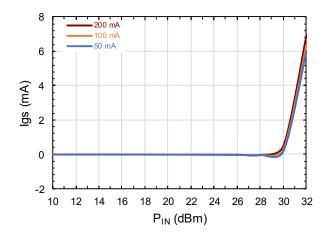
#### Drain Efficiency vs. IDQ and PIN



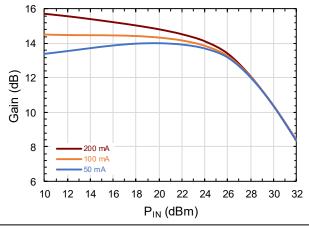
#### Drain Current vs. $I_{DQ}$ and $P_{IN}$



Gate Current vs. IDQ and PIN



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





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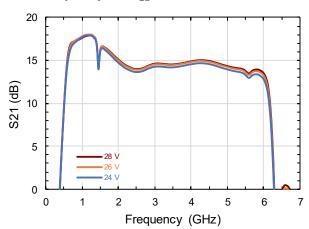
#### Typical Performance Curves as Measured in the 2 - 6 GHz Evaluation Test Fixture:

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.

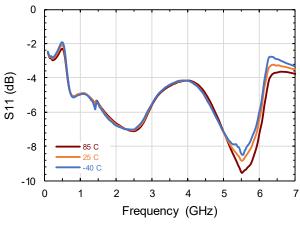
#### S21 vs Frequency and Temperature

## 20 15 10 5 0 0 1 2 3 4 5 6 7 Frequency (GHz)

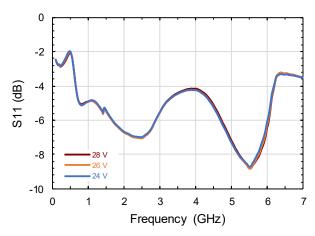
#### S21 vs Frequency and V<sub>DS</sub>



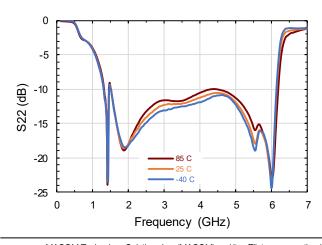
#### S11 vs Frequency and Temperature



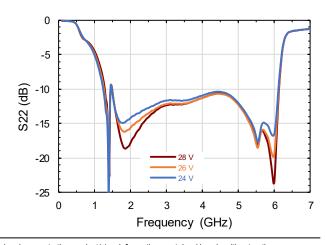
S11 vs Frequency and V<sub>DS</sub>



#### S22 vs Frequency and Temperature



S22 vs Frequency and V<sub>DS</sub>





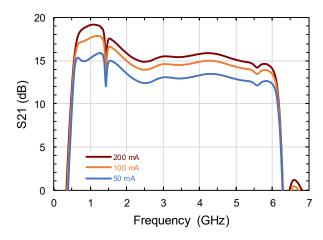
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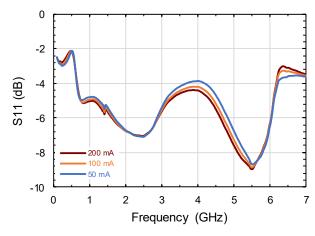
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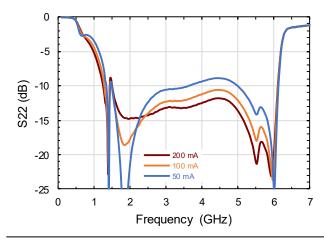
#### S21 vs Frequency and IDQ



#### S11 vs Frequency and IDQ



#### S22 vs Frequency and IDQ

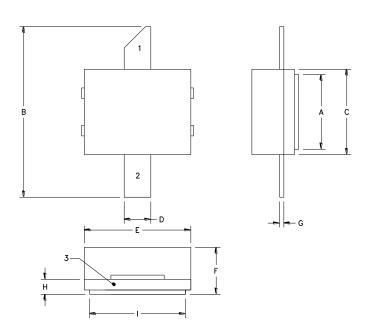




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## Lead-free 440109 Package Dimensions



NOTES: (UNLESS OTHERWISE SPECIFIED)

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

|     | INCHES |      | INCHES MILLIMETERS |      | IETERS |
|-----|--------|------|--------------------|------|--------|
| DIM | MIN    | MAX  | MIN                | MAX  |        |
| Α   | .135   | .145 | 3.43               | 3.68 |        |
| В   | .315   | .325 | 8.00               | 8.26 |        |
| С   | .155   | .165 | 3.94               | 4.19 |        |
| D   | .045   | .055 | 1.14               | 1.40 |        |
| Ε   | .195   | .205 | 4.95               | 5.21 |        |
| F   | .085   | .104 | 2.15               | 2.65 |        |
| G   | .007   | .009 | .178               | 0.23 |        |
| Н   | .026   | .030 | .660               | .762 |        |
| T   | .175   | .185 | 4.45               | 4.70 |        |

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

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



MACOM PURE CARBIDE

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