

Rev. V1

# MACOM PURE CARBIDE..

#### **Features**

Saturated Power: 16 W
Drain Efficiency: 66%
Small Signal Gain: 18 dB
DFN 3 x 4 12 L Plastic Package

RoHS\* Compliant

# **Applications**

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

# **Description**

The MAPC-A3006-AD is a 16 W packaged, unmatched transistor utilizing a high performance, GaN on SiC production process. This transistor supports both defense and commercial related applications.

Offered in a thermally-enhanced flange package, the MAPC-A3006-AD provides superior performance under CW operation allowing customers to improve SWaP-C benchmarks in their next generation systems.

# **Typical RF Performance:**

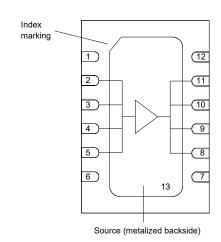
Measured at CW = P<sub>sat</sub>, defined at P<sub>IN</sub> = 28 dBm.
 V<sub>DS</sub> = 28 V, I<sub>DQ</sub> = 100 mA, T<sub>C</sub> = 25°C

Frequency (GHz)	Output Power (dBm)	Gain (dB)	η <sub>□</sub> (%)
3.4	43.1	15.1	65.2
3.7	42.3	14.3	64.5
4.0	42.1	14.1	65.8



3 x 4 mm PDFN-12LD

#### **Functional Schematic**



# **Pin Configuration**

Pin#	Pin Function	Function		
2,3,4,5	RF <sub>IN</sub> / V <sub>G</sub>	RF Input / Gate		
8,9,10,11	RF <sub>OUT</sub> / V <sub>D</sub>	RF Output / Drain		
1,6,7,12,13	Flange <sup>1</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-A3006-AD000	Bulk
MAPC-A3006-ADTR1	Tape and Reel
MAPC-A3006-ADSB1	Sample Board

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



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# RF Electrical Specifications<sup>2</sup>: Freq. = 3.7 GHz, $T_A = +25C$ , $V_{DS} = 28 \text{ V}$ , $I_{DQ} = 100 \text{ mA}$

Parameter	Conditions	Symbol	Min.	Тур.	Max.	Units
Saturated Power	P <sub>IN</sub> = 30 dBm, 1% 25 μs PW	P <sub>SAT</sub>	17.0	19.0	-	W
Drain Efficiency	P <sub>IN</sub> = 30 dBm, 1% 25 μs PW	η <sub>SAT</sub>	63.0	68.4	-	%
Low Power Gain	P <sub>IN</sub> = 10 dBm, 1% 25 μs PW	G <sub>SS</sub>	16.0	17.4	-	dB

<sup>2.</sup> Final testing and screening for all transistor sales is performed using the MAPC-A3006-AD production test circuit at 3.7 GHz.

# Absolute Maximum Ratings<sup>3,4</sup>

Parameter	Absolute Maximum
Drain-Source Voltage	84 V
Gate Voltage	-10, +2 V
Drain Current	1.5 A
Gate Current	3.6 mA
Storage Temperature	-55°C to +150°C
Mounting Temperature	+245°C
Junction Temperature <sup>5,6</sup>	+225°C
Operating Temperature	-40°C to +85°C

- 3. 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.
- 5. Operating at nominal conditions with  $T_J \le +225~^{\circ}C$  will ensure MTTF > 1 x  $10^6$  hours.
- 6. Junction Temperature  $(T_J) = T_C + \Theta jc * (V * I)$ Typical thermal resistance  $(\Theta jc) = 7.3$  °C/W for CW. a) For  $T_C = +25$ °C,  $T_J = 98$  °C @  $P_{DISS} = 10$  W b) For  $T_C = +85$ °C,  $T_J = 158$  °C @  $P_{DISS} = 10$  W

# **Handling Procedures**

Please observe the following precautions to avoid damage:

# **Static Sensitivity**

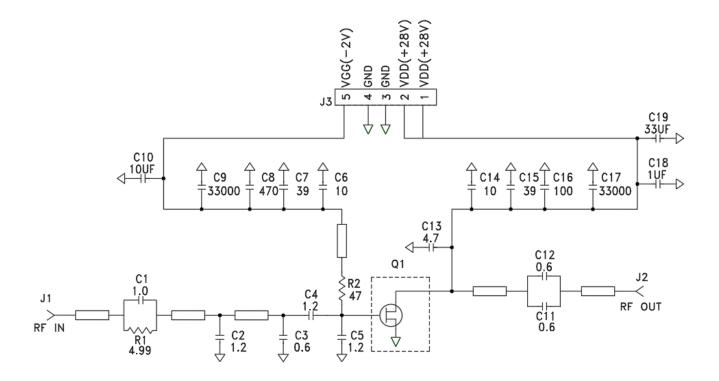
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.



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# **Evaluation Test Fixture and Recommended Tuning Solution, 3.4 - 4.0 GHz**



# **Description**

Parts measured on evaluation board (20-mil thick RO4350). 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

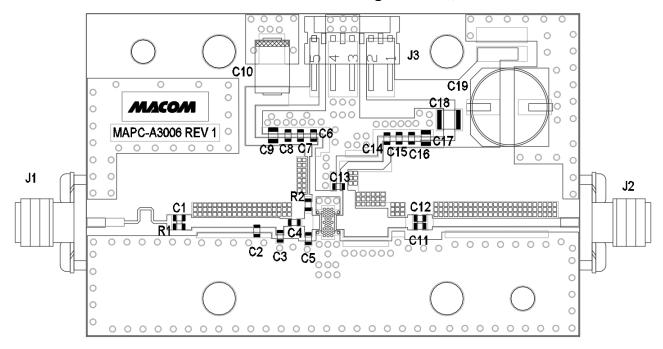
#### **Bias OFF**

- 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



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# **Evaluation Test Fixture and Recommended Tuning Solution, 3.4 - 4.0 GHz**



# **Assembly Parts List**

Reference Designator	Description	Qty.
C1	CAP, 1pF,+/-0.1pF, 0603	1
C2, C4, C5	CAP, 1.2pF,+/-0.05pF, 0603	3
C3, C11, C12	CAP, 0.6pF,+/-0.05pF, 0603	3
C6, C14	CAP, 10.0pF, +/-5%, 0603	2
C7, C15	CAP, 39pF, +/-5%, 0603	2
C8	CAP, 470pF, T5%, 0603, 100V, X7R	1
C9, C17	CAP,33000PF, 0805,100V, X7R	2
C10	CAP, 10UF, 2312, 16V, TANTALUM	1
C13	CAP, 4.7pF,+/-0.1pF, 0603	1
C16	CAP, 100.0pF, +/-5%, 0603	1
C18	CAP, 1.0UF, +/-10%, 1210, 100V, X7R	1
C19	CAP, 33 UF, 20%, G CASE	1
R1	RES, 4.99 OHMS, T1%, 0603, 1/10W	1
R2	RES, 47 OHMS, T1%, 0603, 1/10W	1
J1, J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST	2
J3	HEADER RT>PLZ .1CEN LK 5POS	1
-	PCB RO4350B 0.020" THK	1
Q1	MAPC-A3006-AD GaN Transistor	1



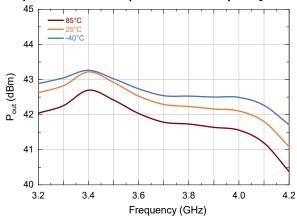
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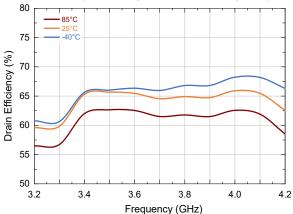
# Typical Performance Curves as Measured in the 3.4–4.0 GHz Evaluation Test Fixture

CW,  $P_{IN}$  =28dBm,  $V_{DS}$  = 28 V,  $I_{DQ}$  = 100 mA, Frequency = 3.7 GHz (Unless Otherwise Noted) For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

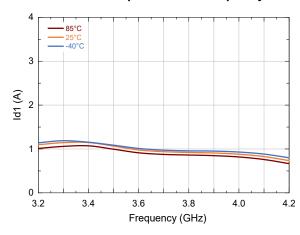
#### Output Power vs. Temperature and Frequency



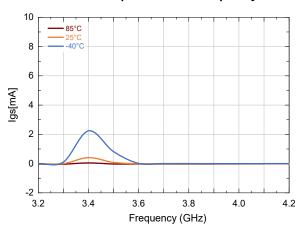
#### Drain Efficiency vs. Temperature and Frequency



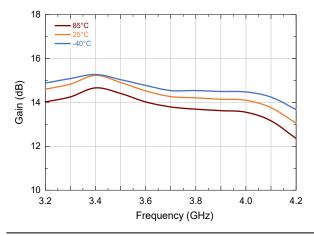
#### Drain Current vs. Temperature and Frequency



Gate Current vs. Temperature and Frequency



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





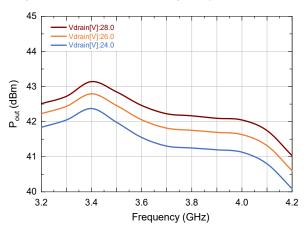
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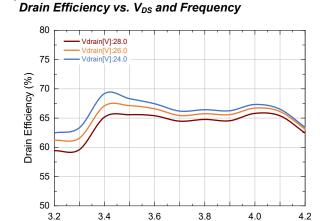
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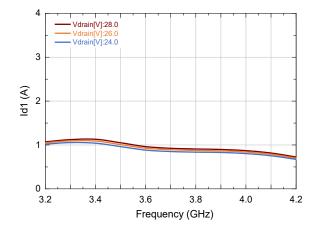
Output Power vs. VDS and Frequency



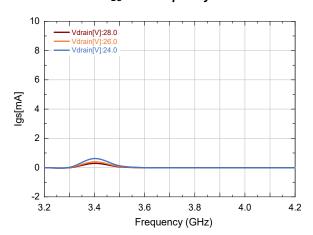


Frequency (GHz)

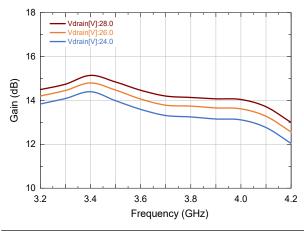
#### Drain Current vs. V<sub>DS</sub> and Frequency



#### Gate Current vs. VDS and Frequency



# Large Signal Gain vs. VDS and Frequency



6



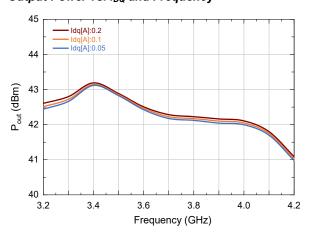
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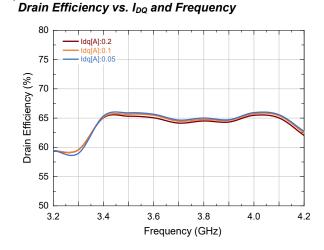
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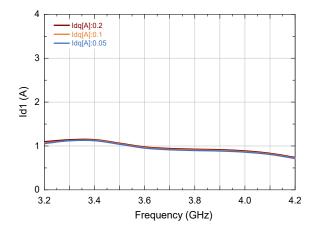
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Output Power vs. IDQ and Frequency

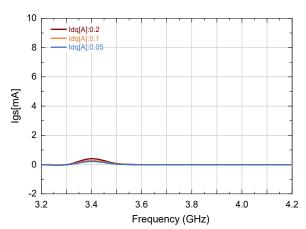




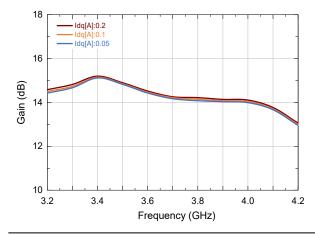
#### Drain Current vs. IDQ and Frequency



#### Gate Current vs. IDQ and Frequency



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





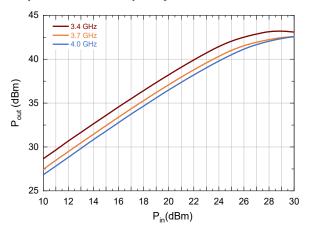
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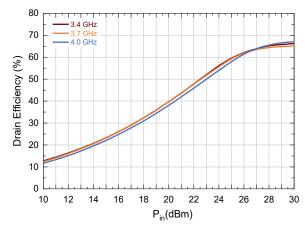
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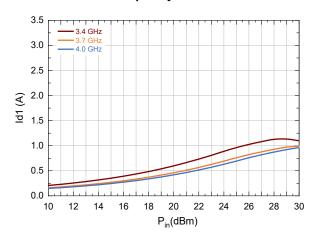
Output Power vs. Frequency and PIN



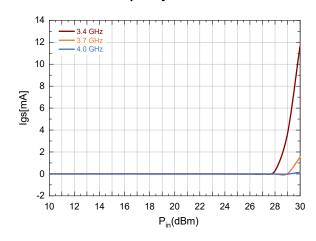
# Drain Efficiency vs. Frequency and PIN



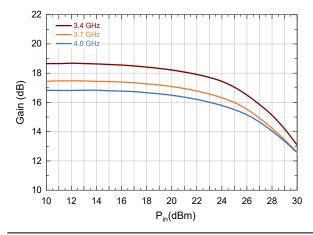
#### Drain Current vs. Frequency and PIN



Gate Current vs. Frequency and PIN



Large Signal Gain vs. Frequency and PIN





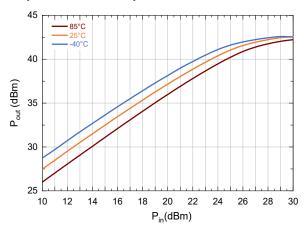
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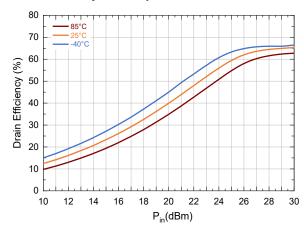
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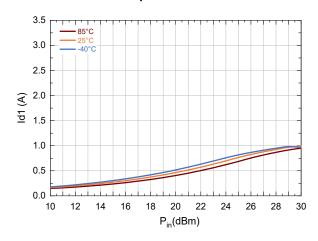
Output Power vs. Temperature and PIN



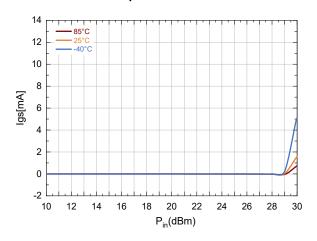
Drain Efficiency vs. Temperature and PIN



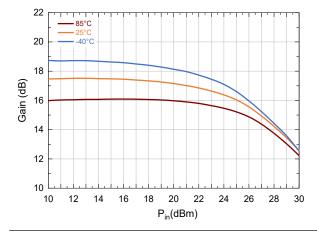
Drain Current vs. Temperature and PIN



Gate Current vs. Temperature and PIN



Large Signal Gain vs. Temperature and PIN





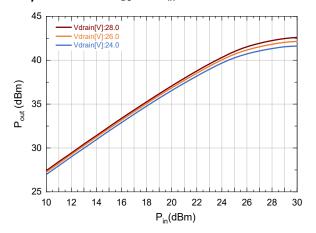
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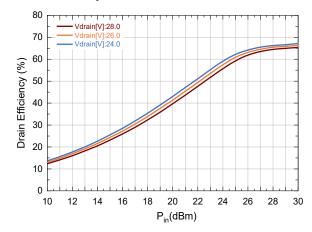
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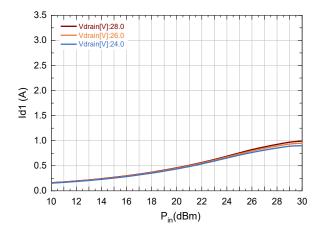
#### Output Power vs. VDS and PIN



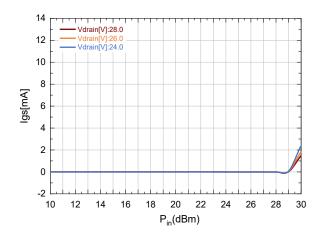
#### Drain Efficiency vs. VDS and PIN



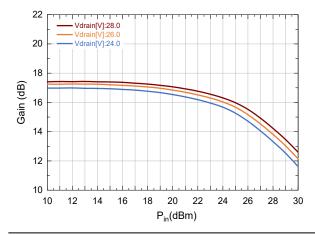
#### Drain Current vs. V<sub>DS</sub> and P<sub>IN</sub>



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



Large Signal Gain vs. VDS and PIN





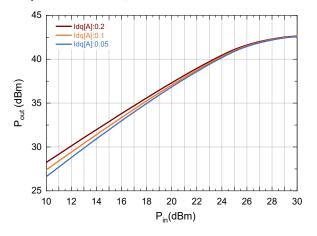
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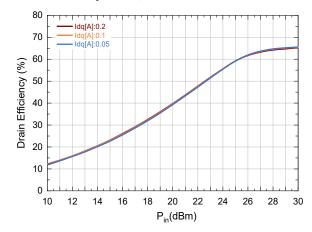
## Typical Performance Curves as Measured in the 3.4–4.0 GHz Evaluation Test Fixture

CW,  $P_{IN}$  =28dBm,  $V_{DS}$  = 28 V,  $I_{DQ}$  = 100 mA, Frequency = 3.7 GHz (Unless Otherwise Noted) For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

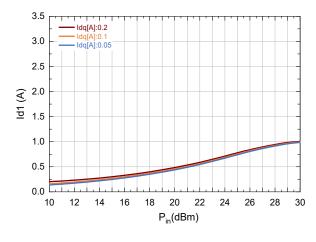
#### Output Power vs. IDQ and PIN



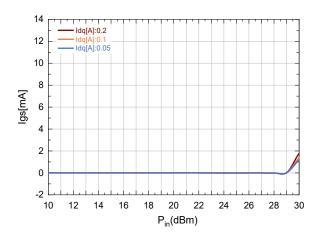
#### Drain Efficiency vs. IDQ and PIN



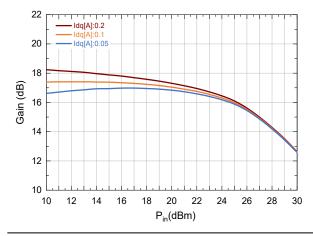
#### Drain Current vs. IDQ and PIN



Gate Current vs. IDQ and PIN



#### Large Signal Gain vs. IDQ and PIN





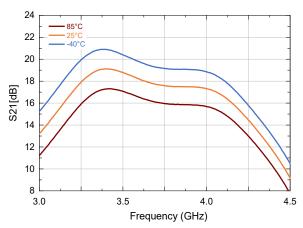
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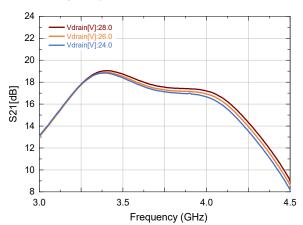
# Typical Performance Curves as Measured in the 3.4– 4.0 GHz Evaluation Test Fixture: CW, $V_{DS}$ = 28 V, $I_{DQ}$ = 100 mA, Pin=-20dBm (Unless Otherwise Noted)

For Engineering Evaluation Only—This data does not Modify MACOM's Datasheet Limits.

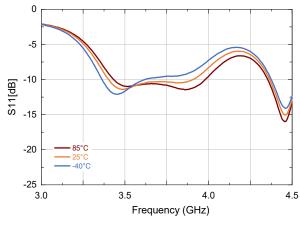
#### S21 vs Frequency and Temperature



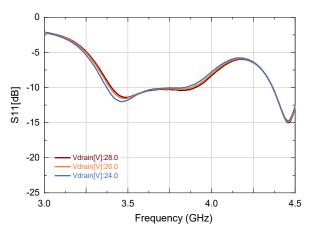
#### S21 vs Frequency and V<sub>DS</sub>



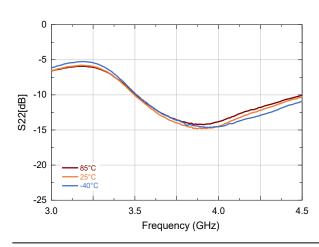
#### S11 vs Frequency and Temperature



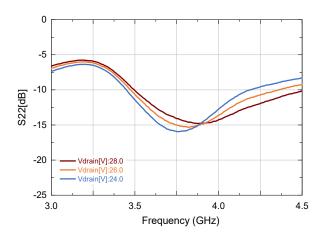
S11 vs Frequency and V<sub>DS</sub>



#### S22 vs Frequency and Temperature



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



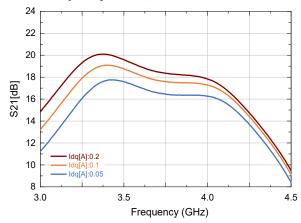


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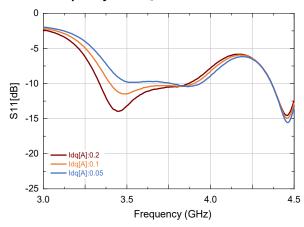
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# Typical Performance Curves as Measured in the 3.4– 4.0 GHz Evaluation Test Fixture: CW, $V_{DS}$ = 28 V, $I_{DQ}$ = 100 mA, Pin=-20dBm (Unless Otherwise Noted) For Engineering Evaluation Only—This data does not Modify MACOM's Datasheet Limits.

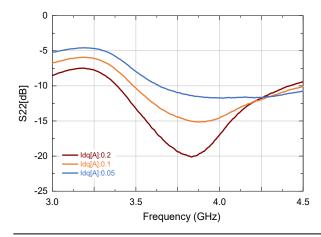
#### S21 vs Frequency and IDO



#### S11 vs Frequency and IDQ



#### S22 vs Frequency and IDQ

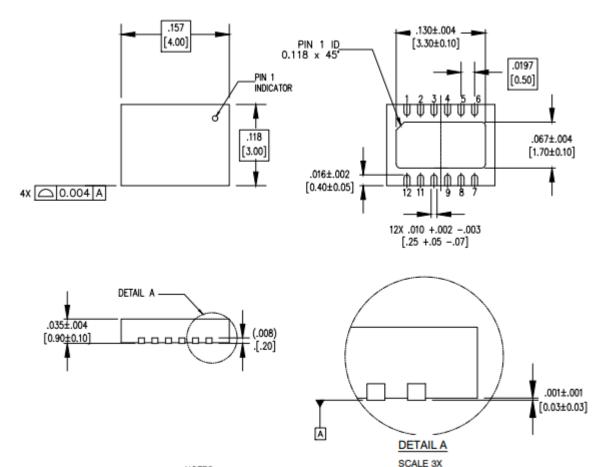




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# MACOM PURE CARBIDE

# Lead-free 3 x 4 mm 12-Lead Package Dimensions



- NOTES:
- ALL DIMENSIONS SHOWN AS in[mm]. CONTROLLING DIMENSIONS ARE IN in. CONVERTED mm DIMENSIONS ARE NOT NECESSARILY EXACT.
- 2. EXPOSED LEADS 100% Sn MATTE.

# GaN on SiC Transistor, 16 W, 28 V DC - 6 GHz



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