# High Power RF GaN Amplifier
# 30 W, 48 V, DC - 6000 MHz

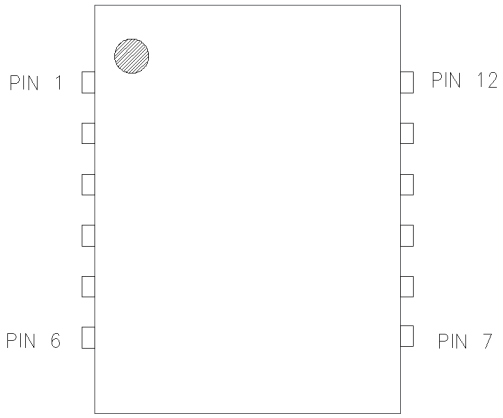
MACOM PURE CARBIDE™

**MAPC-C50030-AD**
**Rev. V2**

## Features

- GaN on SiC HEMT Technology
- Average Output Power: 32 dBm
- Peak Output Power: 30 W
- Low Thermal Resistance
- 100% DC and RF Tested
- RoHS* Compliant


**3 x 4 mm DFN**




## Applications

- Point-to-Point
- Infrastructure

## Description

The MAPC-C50030-AD is an unmatched, gallium nitride (GaN) high electron mobility transistor (HEMT) which offers high efficiency, high gain and wide bandwidth capabilities. These transistors are ideal for tele-communications applications for multiple frequency bands, for example, 700 - 960 MHz, 1200 - 1400 MHz, 1400 - 1500 MHz, 1800 - 2200 MHz, 2500 - 2700 MHz, and 3300 - 3700 MHz. Product is housed in an over-molded 3 x 4 mm DFN package.

## Typical Driver Performance:

$V_{DS}$ = 48 V, $I_{DQm}$ = 80 mA, $V_{GS}$ = -2.6 V
$P_{OUT}$ = 32 dBm, $T_A$ = 25°C
Note: Performance in MACOM Driver Application Fixture. Single Carrier- W-CDMA Channel Bandwidth 85 MHz, PAR 10 dB @ 0.01% CCDF.

| Frequency (MHz) | Gain (dB) | Efficiency (%) | Output PAR (dB) | ACPR (dBc) |
|---|---|---|---|---|
| 1432 | 18.56 | 13.91 | 10.03 | -41.14 |
| 1474 | 18.47 | 13.53 | 9.89 | -42.12 |
| 1517 | 18.34 | 13.41 | 9.65 | -42.39 |

## Pin Configuration

| Pin # | Pin Name | Function |
|---|---|---|
| 1,6,7,12 | Flange[1] | Ground/ Source |
| 2,5,8,11 | N/C | No Connection |
| 3,4 | $RF_{IN}$ / $V_G$ | RF Input / Gate |
| 9,10 | $RF_{OUT}$ / $V_D$ | RF Output / Drain |

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

## Ordering Information

| Part Number | Package |
|---|---|
| MAPC-C50030-ADTR1 | Tape and Reel[2] |
| MAPC-C50030-ADSB1 | Sample Board, 1432 - 1517 MHz, tuned to 7 W |

2. See application note AN-0004525 for Tape & Reel information.

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



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## RF Electrical Characterization: Performance in MACOM Driver Application Fixture

$T_A$ = 25°C, $V_{DS}$ = 48 V, $I_{DQm}$ = 80 mA, $V_{GS}$ = -2.6 V
Note: Performance in MACOM Doherty Application Fixture. Single Carrier- W-CDMA Channel Bandwidth 85 MHz, PAR 10 dB @ 0.01% CCDF

| Parameter | Test Conditions | Symbol | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Power Gain | 1474 MHz, $P_{OUT}$ = 32 dBm | Gp | — | 18.47 | — | dB |
| Drain Efficiency | 1474 MHz, $P_{OUT}$ = 32 dBm | η | — | 13.53 | — | % |
| Output CCDF @ 0.01% | 1474 MHz, $P_{OUT}$ = 32 dBm | PAR | — | 9.89 | — | dB |
| Adjacent Channel Power | 1474 MHz, $P_{OUT}$ = 32 dBm | ACP | — | -42.13 | — | dBc |
| Input Return Loss | 1474 MHz, $P_{OUT}$ = 32 dBm | IRL | — | -10.72 | — | dB |
| Gain Flatness | 1474 MHz, $P_{OUT}$ = 32 dBm | $G_F$ | — | 0.22 | — | dB |
| Gain Variation (-25°C to +105°C) | 1474 MHz, $P_{OUT}$ = 32 dBm | ΔG | — | 0.02 | — | dB/°C |
| Power Variation (-25°C to +105°C) | 1474 MHz, $P_{OUT}$ = 32 dBm | $\Delta P_{3dB}$ | — | 0.008 | — | dB/°C |
| Ruggedness: Output Mismatch | All phase angles | Ψ | VSWR =4:1, No Device Damage | | | |

## RF Electrical Test Specifications: Performance in MACOM Driver Production Test Fixture

$T_A$ = 25°C, $V_{DS}$ = 48 V, $I_{DQm}$ = 80 mA
Note: Performance in MACOM Doherty Production Test Fixture. W-CDMA Channel Bandwidth 85 MHz, PAR 10 dB @ 0.01% CCDF

| Parameter | Test Conditions | Symbol | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Power Gain | 2650 MHz, $P_{OUT}$ = 32 dBm | Gp | 14.0 | 15.4 | — | dB |
| Drain Efficiency | 2650 MHz, $P_{OUT}$ = 32 dBm | η | 12.5 | 13.4 | — | % |
| Output CCDF @ 0.01% | 2650 MHz, $P_{OUT}$ = 32 dBm | PAR | 8.5 | 9.7 | — | dB |
| Adjacent Channel Power | 2650 MHz, $P_{OUT}$ = 32 dBm | ACP | — | -34.6 | -31 | dBc |



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## 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 | $I_{DLK}$ | — | — | 0.6 | mA |
| Drain-Source Leakage Current | $V_{GS}$ = -8 V, $V_{DS}$ = 150 V | $I_{DLK}$ | — | — | 1.6 | mA |
| Gate-Source Leakage Current | $V_{GS}$ = -8 V, $V_{DS}$ = 50 V | $I_{GLK}$ | -0.9 | — | — | mA |
| Gate-Source Leakage Current | $V_{GS}$ = -8 V, $V_{DS}$ = 150 V | $I_{GLK}$ | -1.2 | — | — | mA |
| Gate Threshold Voltage | $V_{DS}$ = 10 V, $I_D$ = 4 mA | $V_T$ | -3.8 | -2.5 | -2.1 | V |

## Recommended Operating Voltages

| Parameter | Test Conditions | Units | Min. | Typ. | Max. |
|---|---|---|---|---|---|
| Drain Operating Voltage | — | V | — | — | 50 |
| Gate Quiescent Voltage | $V_{DS}$ = 48 V, $I_D$ = 80 mA | V | -3.6 | -2.7 | -2.1 |

## ESD Characteristics

| Parameter | Class | Standard |
|---|---|---|
| Human Body Model (HBM) | 1A | JEDEC JESD22 A114-D |
| Charge Device Model (CDM) | 0CB | JEDEC JESD22 C101-C |

## Moisture Sensitivity Level

| Level | Test Standard | Package Temperature | Unit |
|---|---|---|---|
| 3 | IPC/JEDEC J-STD-020 | 260 | °C |



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## Absolute Maximum Ratings[5,6,7,8,9]

| Parameter | Absolute Maximum |
|---|---|
| Drain Source Voltage, $V_{DS}$ | 150 V |
| Gate Source Voltage, $V_{GS}$ | -10 V to 2 V |
| Gate Current , $I_G$ | 4 mA |
| Storage Temperature Range | -65°C to +150°C |
| Case Operating Temperature Range | -40°C to +150°C |
| Channel Operating Temperature Range, $T_{CH}$ | -40°C to +225°C |
| Absolute Maximum Channel Temperature | +225°C |

5. Exceeding any one or combination of these limits may cause permanent damage to this device.
6. MACOM does not recommend sustained operation above maximum operating conditions.
7. Operating at drain source voltage $V_{DS}$ < 55 V will ensure MTTF > 2.51 x $10^6$ hours.
8. Operating at nominal conditions with $T_{CH} \leq 225°C$ will ensure MTTF > 2.51 x $10^6$ hours.
9. MTTF may be estimated by the expression MTTF (hours) = A $e^{[B + C/(T+273)]}$ where *T* is the channel temperature in degrees Celsius, *A* = 1.93, *B* = -45.31, and *C* = 29,585.

## Thermal Characteristics[10]

| Parameter | Test Conditions | Symbol | Typical | Units |
|---|---|---|---|---|
| Thermal Resistance using Infrared Measurement of Die Surface Temperature | $V_{DS}$ = 48 V<br>$T_C$ = 85°C, $T_{CH}$ = 225°C | $R_{\theta}$(IR) | 6.18 | °C/W |

10. Case temperature measured using thermocouple embedded in heat-sink. Contact local applications support team for more details on this measurement.

## Bias Sequencing

### 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 to the gate
3. Turn-off drain voltage
4. Turn-off gate voltage

## Handling Procedures

Please observe the following precautions to avoid damage:

## Static Sensitivity

Gallium Nitride Circuits 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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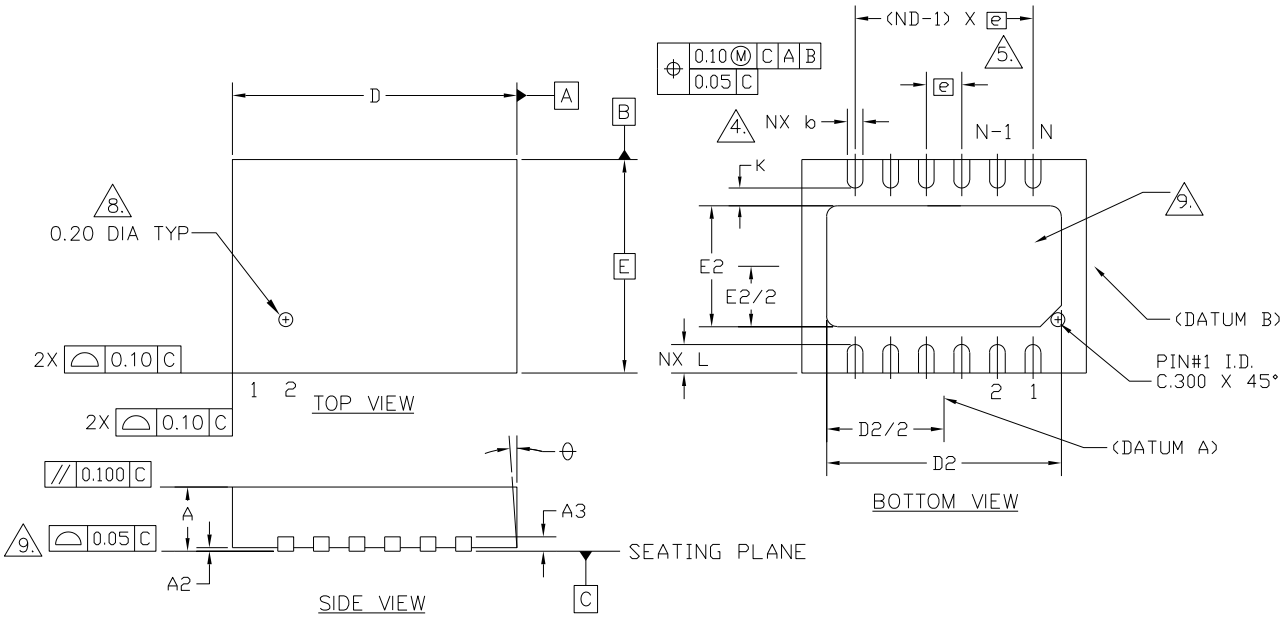
## 3 x 4 mm 12-Lead Package Dimensions

| SYMBOL | COMMON DIMENSIONS | | | NOTE |
|---|---|---|---|---|
| | MIN. | NOM. | MAX. | |
| A | 0.80 | 0.90 | 1.0 | |
| A1 | 0.00 | 0.02 | 0.05 | |
| A3 | | 0.203 REF. | | |
| θ | 0 | —— | 12 | 2 |
| D | | 4.00 BSC | | |
| E | | 3.00 BSC | | |
| e | | 0.50 BSC | | |
| N | | 12 | | 3 |
| ND | | 6 | | 5 |
| L | 0.35 | 0.40 | 0.45 | |
| b | 0.18 | 0.25 | 0.30 | 4 |
| D2 | 3.20 | 3.30 | 3.40 | |
| E2 | 1.60 | 1.7 | 1.80 | |
| K | 0.20 | —— | —— | |



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