

High Power RF GaN Amplifier

60 W, 50 V, 4900 - 5000 MHz



MACOM PURE CARBIDE

MAPC-C50060-AD

Rev. V3

Features

- GaN on SiC HEMT Technology
- Designed for Driver Application
- Average Output Power: 34.4 dBm
- Peak Output Power: 60 W
- Input Pre-matched Device
- Low Thermal Resistance
- 100% DC & RF Tested
- RoHS* Compliant

Applications

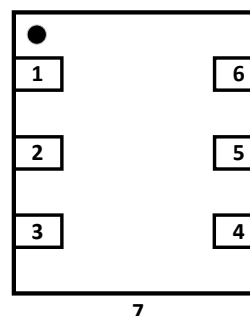
- Point-to-Point
- Infrastructure

Description

The MAPC-C50060-AD is a GaN on Silicon Carbide HEMT Amplifier designed for Driver applications. The device operates as Class-AB amplifier in the application fixture, and it is optimized for the frequency band of 4900 to 5000 MHz. Product is housed in an over-molded 7.0 x 6.5 mm DFN package.



7.0 x 6.5 mm DFN



Typical Driver Performance:

$V_{DS} = 50\text{ V}$, $I_{DQtop} = 36\text{ mA}$, $I_{DQbot} = 36\text{ mA}$,
 $V_{GSpk} = -2.855\text{ V}$, $P_{OUT} = 34.4\text{ dBm}$, $T_A = 25^\circ\text{C}$

Frequency (MHz)	Gain (dB)	Efficiency (%)	Output PAR (dB)	ACPR (dBc)
4900	15.19	16.71	9.78	-43.93
4950	15.08	17.19	9.84	-43.72
5000	14.92	17.79	9.64	-43.99

Note: Performance in MACOM Driver Application Fixture.
Single Carrier- W-CDMA Channel Bandwidth 100 MHz,
PAR 10 dB @ 0.01% CCDF.

Pin Configuration

Pin #	Pin Name	Function
1	RF_{IN} / V_{G1}	RF Input / Gate (Top)
2, 5	N/C	No Connection
3	RF_{IN} / V_{G2}	RF Input / Gate (Bottom)
4	RF_{OUT} / V_{D2}	RF Output / Drain (Bottom)
6	RF_{OUT} / V_{D1}	RF Output / Drain (Top)
7	Flange ²	Ground / Source

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

Ordering Information

Part Number	Package
MAPC-C50060-AD000	Bulk Quantity
MAPC-C50060-ADTR1	Tape and Reel ²
MAPC-C50060-ADSB1	Sample Board, 4900 - 5000 MHz

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

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

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RF Electrical Characterization: in Application Fixture

$T_A = 25^\circ\text{C}$, $V_{DS} = 50\text{ V}$, $I_{DQtop} = 36\text{ mA}$, $I_{DQbot} = 36\text{ mA}$, $V_{GStop} = -2.87\text{ V}$, $V_{GSbot} = -2.87\text{ V}$

Performance in MACOM Driver Application Fixture. Single Carrier- W-CDMA Channel Bandwidth 3.84 MHz, PAR 10 dB @ 0.01% CCDF

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Power Gain	4950 MHz, $P_{OUT} = 34.4\text{ dBm}$	Gp	—	15.08	—	dB
Drain Efficiency	4950 MHz, $P_{OUT} = 34.4\text{ dBm}$	η	—	17.19	—	%
Output CCDF @ 0.01%	4950 MHz, $P_{OUT} = 34.4\text{ dBm}$	PAR	—	9.84	—	dB
Adjacent Channel Power	4950 MHz, $P_{OUT} = 34.4\text{ dBm}$	ACP	—	-43.72	—	dBc
Input Return Loss	4950 MHz, $P_{OUT} = 34.4\text{ dBm}$	IRL	—	-16.24	—	dB
Gain Flatness	4950 MHz, $P_{OUT} = 34.4\text{ dBm}$	G_F	—	0.26	—	dB
Gain Variation (-40°C to +105°C)	4950 MHz, $P_{OUT} = 34.4\text{ dBm}$	ΔG	—	0.02	—	dB/°C
Power Variation (-40°C to +105°C)	4950 MHz	ΔP_{3dB}	—	0.001	—	dB/°C
Ruggedness: Output Mismatch	All Phase Angles	Ψ	VSWR = 4:1, No Device Damage			

RF Electrical Test Specifications: in Production Test Fixture

$T_A = 25^\circ\text{C}$, $V_{DS} = 48\text{ V}$, $I_{DQtop} = 36\text{ mA}$, $I_{DQbot} = 36\text{ mA}$, $V_{GStop} = -2.9\text{ V}$, $V_{GSbot} = -2.9\text{ V}$

Performance in MACOM Doherty Production Test Fixture. LTE 20 MHz, PAR 10dB @ 0.01% CCDF.

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Power Gain	3800 MHz, $P_{OUT} = 34.4\text{ dBm}$	Gp	6	7.4	—	dB
Drain Efficiency	3800 MHz, $P_{OUT} = 34.4\text{ dBm}$	η	9	10.4	—	%
Output CCDF @ 0.01%	3800 MHz, $P_{OUT} = 34.4\text{ dBm}$	PAR	7.5	8.3	—	dB
Adjacent Channel Power	3800 MHz, $P_{OUT} = 34.4\text{ dBm}$	ACP	—	-38.5	-33	dBc

DC Electrical Characteristics: $T_A = 25^\circ\text{C}$

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Top Amplifier						
Drain-Source Leakage Current	$V_{GS} = -8\text{ V}, V_{DS} = 10\text{ V}$	I_{DLK}	—	—	0.6	mA
Drain-Source Leakage Current	$V_{GS} = -8\text{ V}, V_{DS} = 150\text{ V}$	I_{DLK}	—	—	1.4	mA
Gate-Source Leakage Current	$V_{GS} = -8\text{ V}, V_{DS} = 50\text{ V}$	I_{GLK}	-0.9	—	—	mA
Gate-Source Leakage Current	$V_{GS} = -8\text{ V}, V_{DS} = 150\text{ V}$	I_{GLK}	-1.1	—	—	mA
Gate Threshold Voltage	$V_{DS} = 10\text{ V}, I_D = 3.6\text{ mA}$	V_T	-3.8	-2.7	-2.1	V
Bottom Amplifier						
Drain-Source Leakage Current	$V_{GS} = -8\text{ V}, V_{DS} = 10\text{ V}$	I_{DLK}	—	—	0.6	mA
Drain-Source Leakage Current	$V_{GS} = -8\text{ V}, V_{DS} = 150\text{ V}$	I_{DLK}	—	—	1.4	mA
Gate-Source Leakage Current	$V_{GS} = -8\text{ V}, V_{DS} = 50\text{ V}$	I_{GLK}	-0.9	—	—	mA
Gate-Source Leakage Current	$V_{GS} = -8\text{ V}, V_{DS} = 150\text{ V}$	I_{GLK}	-1.1	—	—	mA
Gate Threshold Voltage	$V_{DS} = 10\text{ V}, I_D = 3.6\text{ mA}$	V_T	-3.8	-2.7	-2.1	V

Recommended Operating Voltages

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Drain Operating Voltage	—	V	—	—	50
Gate Quiescent Voltage	$V_{DS} = 48\text{ V}, I_D = 36\text{ mA}$	V	-3.6	-2.81	-2.1

ESD Characteristics

Parameter	Class	Standard
Human Body Model (HBM)	1A	JEDEC JESD22 A114-D
Charge Device Model (CDM)	C2	JEDEC JESD22 C101-C

Moisture Sensitivity Level

Level	Test Standard	Package Temperature	Unit
3	IPC/JEDEC J-STD-020	260	$^\circ\text{C}$

Absolute Maximum Ratings^{5,6,7,8,9}

Parameter	Absolute Maximum
Drain Source Voltage, V_{DS}	125 V
Gate Source Voltage, V_{GS}	-10 to 3 V
Gate Current (Top), I_G	22.1 mA
Gate Current (Bot), I_G	22.1 mA
Storage Temperature Range	-65°C to +150°C
Channel Operating Temperature Range, T_{CH}	-40°C to +225°C
Absolute Maximum Channel Temperature	+225°C

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

Thermal Characteristics¹⁰

Parameter	Test Conditions	Symbol	Typical	Units
Thermal Resistance using Infrared Measurement of Die Surface Temperature	$V_{DS} = 50$ V $T_C = 125^\circ\text{C}$, $T_{CH} = 225^\circ\text{C}$	$R_{\theta}(\text{IR})$	8.32	°C/W

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

Bias Sequencing

Bias ON

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

Bias OFF

- Turn RF off
- Apply pinch-off voltage to the gate
- Turn-off drain voltage
- Turn-off gate voltage

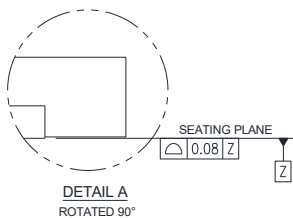
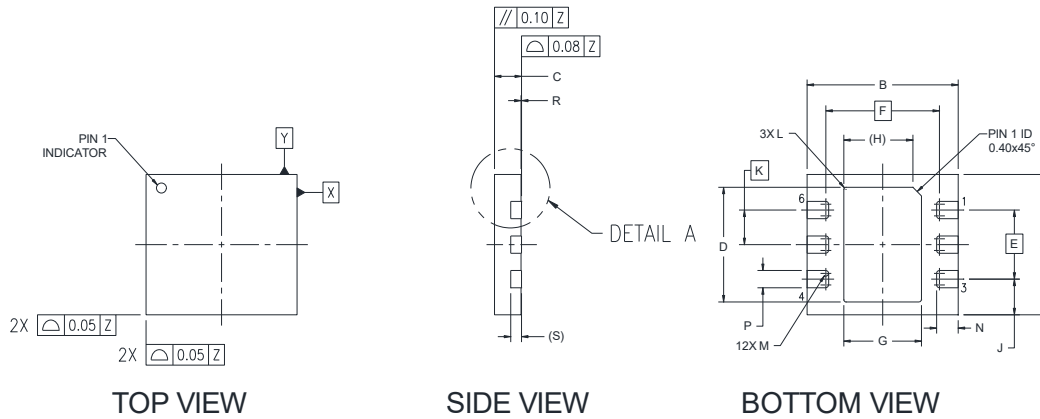
Handling Procedures

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.

7.0 x 6.5 mm 6-Lead Package Dimensions



DIM	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
A	0.254	0.256	0.258	6.45	6.5	6.55
B	0.274	0.276	0.278	6.95	7	7.05
C	0.045	0.049	0.053	1.15	1.25	1.35
D	0.205	0.209	0.213	5.21	5.31	5.41
E	-	0.126	-	-	3.2	-
F	-	0.207	-	-	5.26	-
G	0.138	0.142	0.146	3.5	3.6	3.7
H	-	0.126	-	-	3.2	-
J	0.063	0.065	0.067	1.6	1.65	1.7
K	-	0.063	-	-	1.6	-
L	-	0.004	0.008	-	0.1	0.2
M	-	0.005	0.016	-	0.13	0.4
N	0.035	0.039	0.043	0.9	1	1.1
P	0.03	0.031	0.033	0.75	0.8	0.85
R	0	0.001	0.002	0	0.02	0.05
S	-	0.02	-	-	0.5	-

† Interpret dimensions and tolerances per ASME Y14.5M-1994.

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