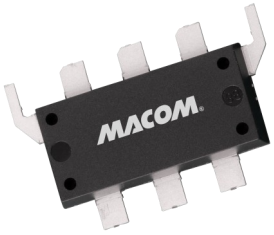
High Power RF GaN Amplifier
450 W, 48 V, 3450 - 4000 MHz

MACOM PURE CARBIDE

MAPC-C40450-CP
Rev. V1

Features

- GaN on SiC HEMT Technology
- Designed for Asymmetrical Doherty Application
- Average Output Power: 47.5 dBm
- Peak Output Power: 450 W
- Input and Output Pre-matched Device
- Low Thermal Resistance
- 100% DC and RF Tested
- RoHS* Compliant



TO-248-6/2

Applications

- Infrastructure

Description

The MAPC-C40450-CP is a GaN on Silicon Carbide HEMT Amplifier designed for asymmetrical Doherty applications. The device is optimized for the frequency band of 3450 to 4000 MHz. Product is housed in an over-molded TO-package.

Typical Doherty Performance:

V_{DS} = 48 V, I_{DQm} = 280 mA, V_{GSpk}= V_{GS} @ I_{DQ}(peak) = 560 mA – 1.3 V, P_{OUT} = 47.5 dBm, T_A = 25°C
Note: Performance in MACOM Doherty Application Fixture. Single Carrier- W-CDMA Channel Bandwidth 3.84 MHz, PAR 10 dB @ 0.01% CCDF.

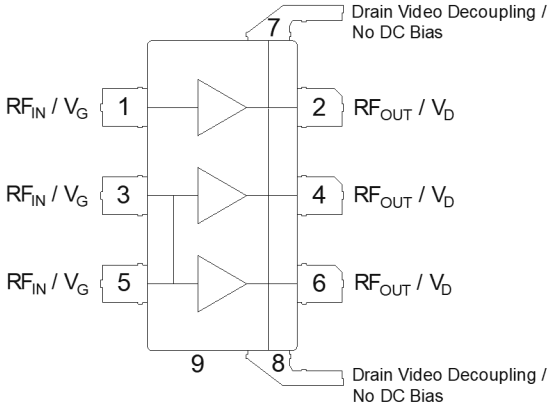
Frequency (MHz)	Gain (dB)	Efficiency (%)	Output PAR (dB)	ACPR (dBc)
3450	11.2	42.7	8.1	-27.6
3725	12.5	47.2	8.2	-30.3
4000	11.4	41.9	8.4	-30.7

Ordering Information

Part Number	Package
MAPC-C40450-CPTR1	250 pc Tape and Reel[1]
MAPC-C40450-CPTR2	50 pc Tape and Reel[1]
MAPC-C40450-CPSB1	Sample Board

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

Functional Schematic



Pin Configuration

Pin #	Pin Name	Function
1	RF_{IN} / V_{G1}	RF Input / Gate (Main)
2	RF_{OUT} / V_{D1}	RF Output / Drain (Main)
3,5	RF_{IN} / V_{G2}	RF Input / Gate (Peak)
4,6	RF_{OUT} / V_{D2}	RF Output / Drain (Peak)
7,8	VBW Lead	Drain Video Decoupling. No DC Bias
9	Flange[2]	Ground / Source

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

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

RF Electrical Characterization:

Freq. = 4000 MHz, P_{OUT} = 47.5 dBm, T_A = 25°C, V_{DS} = 48 V, I_{DQm} = 280 mA, V_{GSpk}= V_{GS} @ I_{DQ}(peak) = 560 mA – 1.3 V Performance in MACOM Doherty 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	—	Gp	—	11.0	—	dB
Drain Efficiency	—	η	—	39.9	—	%
Output CCDF @ 0.01%	—	PAR	—	8.3	—	dB
Adjacent Channel Power	—	ACP	—	-29.9	—	dBc
Input Return Loss	—	IRL	—	-16.2	—	dB
Gain Flatness	—	G_F	—	0.53	—	dB
Gain Variation	-40°C to +105°C	ΔG	—	0.0284	—	dB/°C
Power Variation	-40°C to +105°C, Pulsed 10% DC	ΔP_{3dB}	—	0.00503	—	dB/°C
Ruggedness: Output Mismatch	All phase angles	Ψ	VSWR =10:1, No Device Damage			

RF Electrical Test Specifications:

Freq. = 4000 MHz, P_{OUT} = 47.5 dBm, T_A = 25°C, V_{DS} = 48 V, I_{DQm} = 280 mA, V_{GSpk}= V_{GS} @ I_{DQ}(peak) = 560 mA – 0.7 V Performance in MACOM Doherty Production Test Fixture. Single Carrier- W-CDMA Channel Bandwidth 3.84 MHz, PAR 10 dB @ 0.01% CCDF.

Parameter	Symbol	Min.	Typ.	Max.	Units
Power Gain	Gp	10.0	12.1	—	dB
Drain Efficiency	η	28.0	36.7	—	%
Output CCDF @ 0.01%	PAR	6.5	7.3	—	dB
Adjacent Channel Power	ACP	—	-29.1	-24	dBc

DC Electrical Characteristics T_A = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Main Amplifier						
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{DLK}	—	—	13.3	mA
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 100 V	I_{DLK}	—	—	11.8	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{GLK}	-4.4	-	-	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 100 V	I_{GLK}	-2.0	-	-	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 28 mA	V_T	-3.8	-2.8	-2.1	V
Peak Amplifier						
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{DLK}	—	—	13.3	mA
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 100 V	I_{DLK}	—	—	11.8	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{GLK}	-8.8	-	-	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 100 V	I_{GLK}	-4.0	-	-	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 56 mA	V_T	-3.8	-2.8	-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 = 280 mA	V	-3.8	-2.8	-2.1

ESD Characteristics

Parameter	Class	Standard
Human Body Model (HBM)	Class 3A	ANSI/ESDA/JEDEC JS-001
Charge Device Model (CDM)	Class C3	ANSI/ESDA/JEDEC JS-002

Moisture Sensitivity Level

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

Absolute Maximum Ratings[3,4,5,6,7]

Parameter	Absolute Maximum
Drain Source Voltage, V_{DS}	100 V
Operating Voltage, V_{DS}	55 V
Gate Source Voltage, V_{GS}	-10 to 2 V
Gate Current (Main), I_G	28 mA
Gate Current (Peak), I_G	56 mA
Storage Temperature Range	-65°C to +150°C
Case Operating Temperature Range	-40°C to +125°C
Channel Operating Temperature Range, T_{CH}	-40°C to +225°C
Absolute Maximum Channel Temperature	+225°C

3. Exceeding any one or combination of these limits may cause permanent damage to this device.
4. MACOM does not recommend sustained operation above maximum operating conditions.
5. Operating at drain source voltage V_{DS} < 55V will ensure MTTF > 2.51 x 10^6 hours.
6. Operating at nominal conditions with $T_{CH} \leq 225°C$ will ensure MTTF > 2.51 x 10^6 hours.
7. 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[8]

Parameter	Test Conditions	Symbol	Typical	Units
Thermal Resistance using Infrared Measurement of Die Surface Temperature	P_{DISS} = 123 W T_C = 85°C, T_{CH} = 225°C	R_{θ}(IR)	0.99	°C/W

8. 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

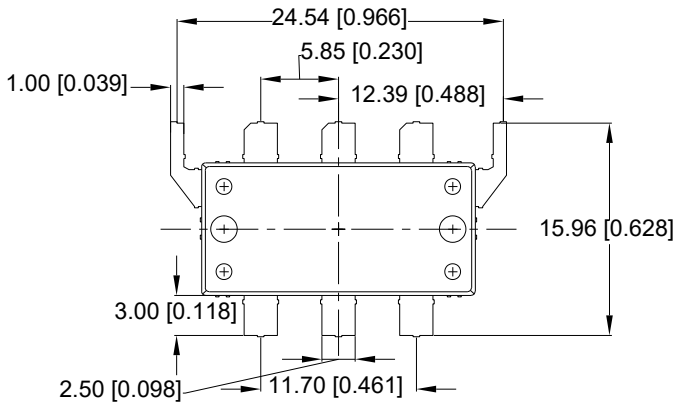
Handling Procedures

Please observe the following precautions to avoid damage:

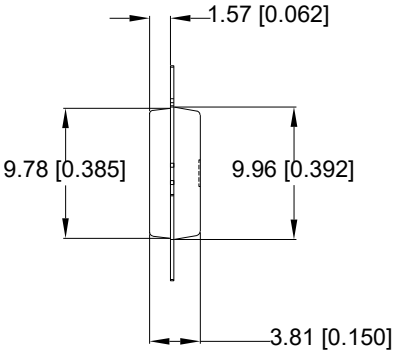
Static Sensitivity

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.

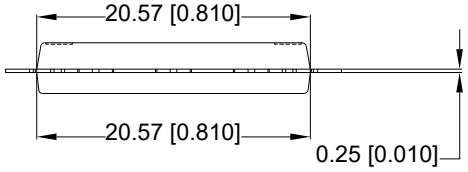
TO-248-6/2 Package Dimensions



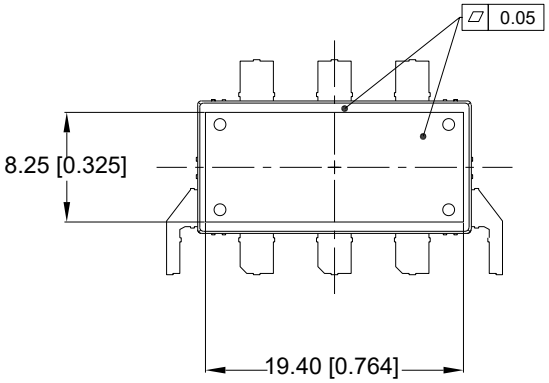
TOP VIEW



RIGHT SIDE VIEW



FRONT VIEW



BOTTOM VIEW

Remarks:

1. All dimensions shown as mm[in]. Controlling dimensions are in mm and converted in. Dimensions are not necessarily exact.
2. All tolerance are ±.05[.002] unless otherwise noted.
3. Metal protrusions are connected to source and shall not exceed 0.10mm max.
4. Fillets and radii:-
   Unless otherwise noted all radii are 0.30mm max.
5. Molded package Ra 1.2-1.6um.
6. All metal surfaces are tin plated, except area of cut.