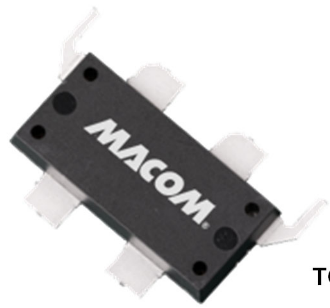
High Power RF GaN Amplifier
640 W, 50 V, 2110 - 2200 MHz

MACOM PURE CARBIDE

MAPC-C22641-DP
Rev. V1

Features
- GaN on SiC HEMT Technology
- Designed for Asymmetrical Doherty Application
- Average Output Power: 49.3 dBm
- Peak Output Power: 640 W
- Input and Output Pre-matched Device
- Low Thermal Resistance
- 100% DC and RF Tested
- RoHS* Compliant



TO-248-4/2

Applications
- Infrastructure

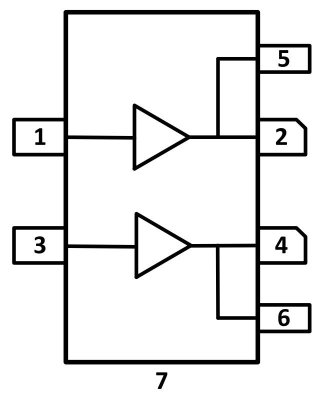
Description
The MAPC-C22641-DP is a GaN on Silicon Carbide HEMT Amplifier designed for asymmetrical Doherty applications. The device is optimized for the frequency band of 2110 to 2200 MHz. This product is housed in an over-molded TO-package.

Typical Doherty Performance:
V_{DS} = 50 V, I_{DQm} = 250 mA, V_{GSpk} = V_{GSpk}(500 mA) - 1.6 V, P_{OUT} = 49.3 dBm, T_A = 25°C

Frequency (MHz)	Gain (dB)	Efficiency (%)	Output PAR (dB)	ACPR (dBc)
2110	17.5	57.0	8.0	-27.9
2155	17.5	57.8	7.7	-27.4
2200	17.0	57.1	7.6	-27.3

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

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	RF_{IN} / V_{G2}	RF Input / Gate (Peak)
4	RF_{OUT} / V_{D2}	RF Output / Drain (Peak)
5,6	VBW Lead	Drain Video Decoupling. No DC Bias
7	Flange[2]	Ground / Source

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

Ordering Information

Part Number	Package
MAPC-C22641-DPTR1	250 pc Tape and Reel[1]
MAPC-C22641-DPTR2	50 pc Tape and Reel[1]
MAPC-C22641-DPSB1	Sample Board

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

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

RF Electrical Characterization:

Freq. = 2200 MHz, P_{OUT} = 49.3 dBm, T_A = 25°C, V_{DS} = 50 V, I_{DQm} = 250 mA, V_{GSpk} = V_{GSpk}(500 mA) - 1.6 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	—	17.1	—	dB
Drain Efficiency	—	η	—	57.1	—	%
Output CCDF @ 0.01%	—	PAR	—	7.6	—	dB
Adjacent Channel Power	—	ACP	—	-27.3	—	dBc
Input Return Loss	—	IRL	—	-23.2	—	dB
Gain Flatness	—	G_F	—	0.9	—	dB
Gain Variation	-40°C to +105°C	ΔG	—	-0.011	—	dB/°C
Power Variation	-40°C to +105°C, Pulsed 10% DC	ΔP_{3dB}	—	0.0039	—	dB/°C
Ruggedness: Output Mismatch	All phase angles	Ψ	VSWR = 10:1, No Device Damage			

RF Electrical Test Specifications:

P_{OUT} = 49.3 dBm, T_A = 25°C, V_{DS} = 48 V, I_{DQm} = 250 mA, V_{GSPK} = V_{GSpk}(500 mA) - 2.0 V
Performance in MACOM Doherty Production Test 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	2110 MHz 2200 MHz	Gp	15.5 15.0	16.3 16.1	—	dB
Drain Efficiency	2110 MHz 2200 MHz	η	52.0 53.0	58.0 59.0	—	%
Output CCDF @ 0.01%	2110 MHz 2200 MHz	PAR	6.5 5.5	7.7 7.6	—	dB
Adjacent Channel Power	2110 MHz 2200 MHz	ACP	—	-24.6 -24.3	-22.0 -21.0	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}	—	—	3.5	mA
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 100 V	I_{DLK}	—	—	7.0	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{GLK}	- 3.5	—	—	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 100 V	I_{GLK}	- 3.0	—	—	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 25 mA	V_T	- 3.5	- 2.3	- 1.7	V
Peak Amplifier						
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{DLK}	—	—	7.0	mA
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 100 V	I_{DLK}	—	—	14.0	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{GLK}	- 7.0	—	—	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 100 V	I_{GLK}	- 6.0	—	—	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 50 mA	V_T	- 3.5	- 2.2	- 1.7	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 = 250 mA	V	-3.5	-2.28	-1.9

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	25 mA
Gate Current (Peak), I_G	50 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} < 55 V will ensure MTTF > 2.51×10^6 hours.
6. Operating at nominal conditions with $T_{CH} \leq 225°C$ will ensure MTTF > 2.51×10^6 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 Finite Element Analysis, T_J	P_{DISS} = 84 W T_C = 116°C, T_{CH} = 225°C	R_θ(FEA)	1.3	°C/W
Thermal Resistance using Infrared Measurement of Die Surface Temperature		R_θ(IR)	1.1	°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

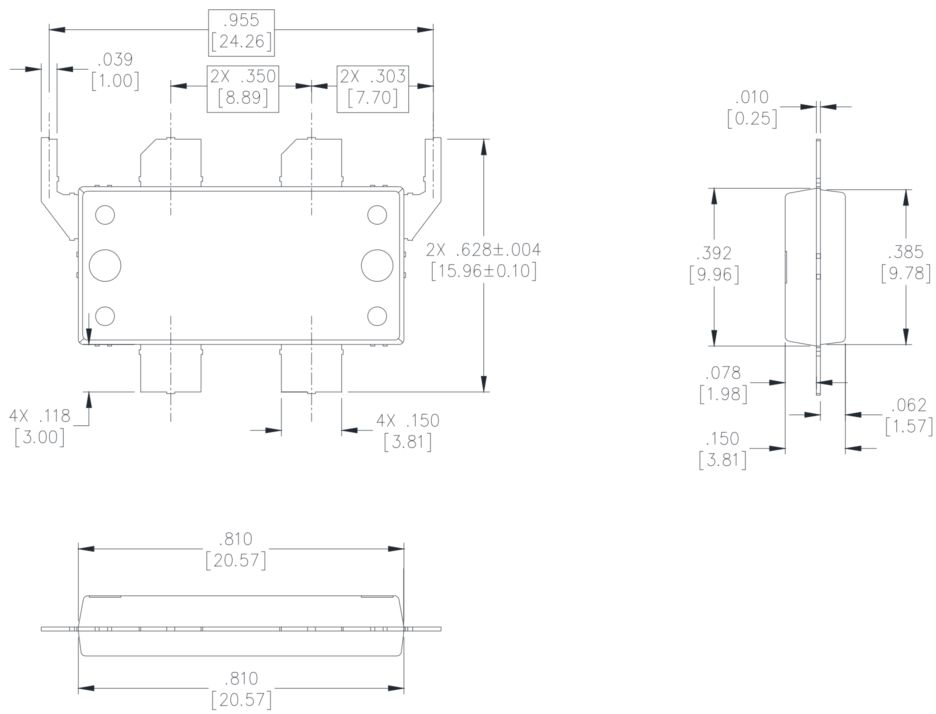
Handling Procedures

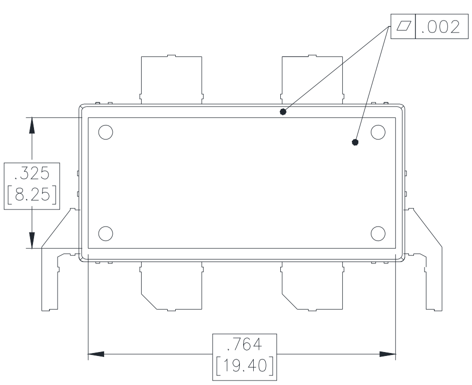
Please observe the following precautions to avoid damage:

Static Sensitivity

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.

TO-248-4/2 Package Dimensions





NOTES:

1. ALL DIMENSIONS SHOWN AS in[mm]. CONTROLLING DIMENSIONS ARE IN in AND CONVERTED mm DIMENSIONS ARE NOT NECESSARILY EXACT.
2. ALL TOLERANCES ARE ±.002 [0.05] UNLESS OTHERWISE NOTED.
3. ALL METAL SURFACES ARE MATTE Sn PLATED EXCEPT FOR CUT EDGES.
4. PACKAGE BODY AND LEAD DIMENSIONS DO NOT INCLUDE MOLD AND METAL PROTRUSIONS. ALLOWABLE PROTRUSION IS .012 [0.30] IN GENERAL AND .004 [0.10] FOR PROTRUSIONS CONNECTED TO SOURCE