

## Features

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

## Applications

- Infrastructure

## Description

The MAPC-C18641-DP is a GaN on Silicon Carbide HEMT Amplifier designed for asymmetrical Doherty applications. The device is optimized for the frequency band of 1805 to 1880 MHz. Product is housed in an over-molded TO-package.

## Typical Doherty Performance:

$V_{DS} = 48$  V,  $I_{DQm} = 250$  mA,  $V_{GSpk} = 500$  mA - 2.4 V

$P_{OUT} = 49.3$  dBm,  $T_A = 25^\circ\text{C}$

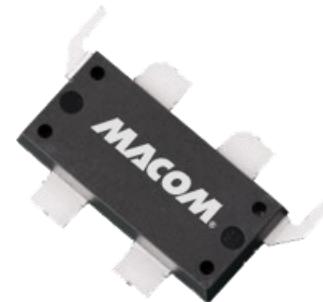
Note: Performance in MACOM Doherty Application Fixture. Single Carrier-W-CDMA Channel Bandwidth 3.84 MHz, PAR 10 dB @ 0.01% CCDF.

Frequency (MHz)	Gain (dB)	Efficiency (%)	Output PAR (dB)	ACPR (dBc)
1805.0	18.0	57.5	7.58	-25.2
1842.5	18.1	57.4	7.81	-25.3
1880.0	18.0	57.1	7.72	-25.2

## Ordering Information

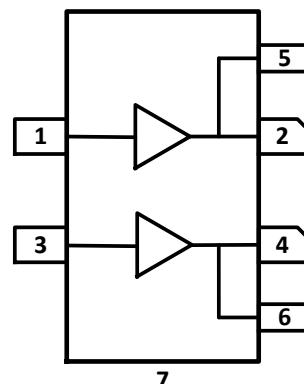
Part Number	Package
MAPC-C18641-DPTR1	250 pc Tape and Reel <sup>1</sup>
MAPC-C18641-DPTR2	50 pc Tape and Reel <sup>1</sup>
MAPC-C18641-DPSB1	Sample Board

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



TO-248-4/2

## 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 <sup>2</sup>	Ground / Source

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

<sup>1</sup> \* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

<sup>2</sup> MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

**RF Electrical Characterization:**

$T_A = 25^\circ\text{C}$ ,  $V_{DS} = 48\text{ V}$ ,  $I_{DQm} = 250\text{ mA}$ ,  $V_{GSpk} = 500\text{ mA} - 2.4\text{ V}$

Note: 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	1880 MHz, $P_{OUT} = 49.3\text{ dBm}$	$G_p$	—	18.0	—	dB	
Drain Efficiency	1880 MHz, $P_{OUT} = 49.3\text{ dBm}$	$\eta$	—	57.0	—	%	
Output CCDF @ 0.01%	1880 MHz, $P_{OUT} = 49.3\text{ dBm}$	PAR	—	7.7	—	dB	
Adjacent Channel Power	1880 MHz, $P_{OUT} = 49.3\text{ dBm}$	ACP	—	-25.2	—	dBc	
Input Return Loss	1880 MHz, $P_{OUT} = 49.3\text{ dBm}$	IRL	—	-11.7	—	dB	
Gain Flatness	1880 MHz, $P_{OUT} = 49.3\text{ dBm}$	$G_F$	—	0.10	—	dB	
Gain Variation (-40°C to +105°C)	1880 MHz, $P_{OUT} = 49.3\text{ dBm}$	$\Delta G$	—	0.011	—	dB/°C	
Power Variation (-40°C to +105°C)	1880 MHz, Pulsed 10% DC	$\Delta P_{3dB}$	—	0.0069	—	dB/°C	
Ruggedness: Output Mismatch	All phase angles	$\Psi$	VSWR = 10:1, No Device Damage				

**RF Electrical Test Specifications:**

$P_{OUT} = 49.3\text{ dBm}$ ,  $T_A = 25^\circ\text{C}$ ,  $V_{DS} = 48\text{ V}$ ,  $I_{DQm} = 250\text{ mA}$ ,  $V_{GSpk} = 500\text{ mA} - 2.0\text{ V}$

Note: 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	1805 MHz 1880 MHz	$G_p$	17.0 17.0	17.7 18.0	—	dB
Drain Efficiency	1805 MHz 1880 MHz	$\eta$	52.0 53.0	56.2 55.5	—	%
Output CCDF @ 0.01%	1805 MHz 1880 MHz	PAR	6.3 6.4	7.2 7.0	—	dB
Adjacent Channel Power	1805 MHz 1880 MHz	ACP	—	-25.7 -24.3	-24.0 -22.0	dBc

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

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
<b>Main Amplifier</b>						
Drain-Source Leakage Current	$V_{GS} = -8 \text{ V}$ , $V_{DS} = 10 \text{ V}$	$I_{DLK}$	—	—	3.5	mA
Drain-Source Leakage Current	$V_{GS} = -8 \text{ V}$ , $V_{DS} = 100 \text{ V}$	$I_{DLK}$	—	—	7.0	mA
Gate-Source Leakage Current	$V_{GS} = -8 \text{ V}$ , $V_{DS} = 10 \text{ V}$	$I_{GLK}$	-3.5	—	—	mA
Gate-Source Leakage Current	$V_{GS} = -8 \text{ V}$ , $V_{DS} = 100 \text{ V}$	$I_{GLK}$	-3.0	—	—	mA
Gate Threshold Voltage	$V_{DS} = 10 \text{ V}$ , $I_D = 250 \text{ mA}$	$V_T$	-3.5	-2.3	-1.7	V
<b>Peak Amplifier</b>						
Drain-Source Leakage Current	$V_{GS} = -8 \text{ V}$ , $V_{DS} = 10 \text{ V}$	$I_{DLK}$	—	—	7.0	mA
Drain-Source Leakage Current	$V_{GS} = -8 \text{ V}$ , $V_{DS} = 100 \text{ V}$	$I_{DLK}$	—	—	14.0	mA
Gate-Source Leakage Current	$V_{GS} = -8 \text{ V}$ , $V_{DS} = 10 \text{ V}$	$I_{GLK}$	-7.0	—	—	mA
Gate-Source Leakage Current	$V_{GS} = -8 \text{ V}$ , $V_{DS} = 100 \text{ V}$	$I_{GLK}$	-6.0	—	—	mA
Gate Threshold Voltage	$V_{DS} = 10 \text{ V}$ , $I_D = 500 \text{ mA}$	$V_T$	-3.5	-2.3	-1.7	V

**Recommended Operating Voltages**

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Drain Operating Voltage	—	V	—	50	—
Gate Quiescent Voltage	$V_{DS} = 48 \text{ V}$ , $I_D = 250 \text{ mA}$	V	-3.5	-2.3	-1.9

**Moisture Sensitivity Level**

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

**Absolute Maximum Ratings<sup>3,4,5,6,7</sup>**

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  $MTTF > 2.51 \times 10^6$  hours.
6. Operating at nominal conditions with  $T_{CH} \leq 225^\circ\text{C}$  will ensure  $MTTF > 2.51 \times 10^6$  hours.
7. 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 Characteristics<sup>8</sup>**

Parameter	Test Conditions	Symbol	Typical	Units
Thermal Resistance using Finite Element Analysis, $T_J$	$P_{DISS} = 84$ W $T_C = 116^\circ\text{C}$ , $T_{CH} = 225^\circ\text{C}$	$R_\theta$ (FEA)	1.3	°C/W
Thermal Resistance using Infrared Measurement of Die Surface Temperature		$R_\theta$ (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

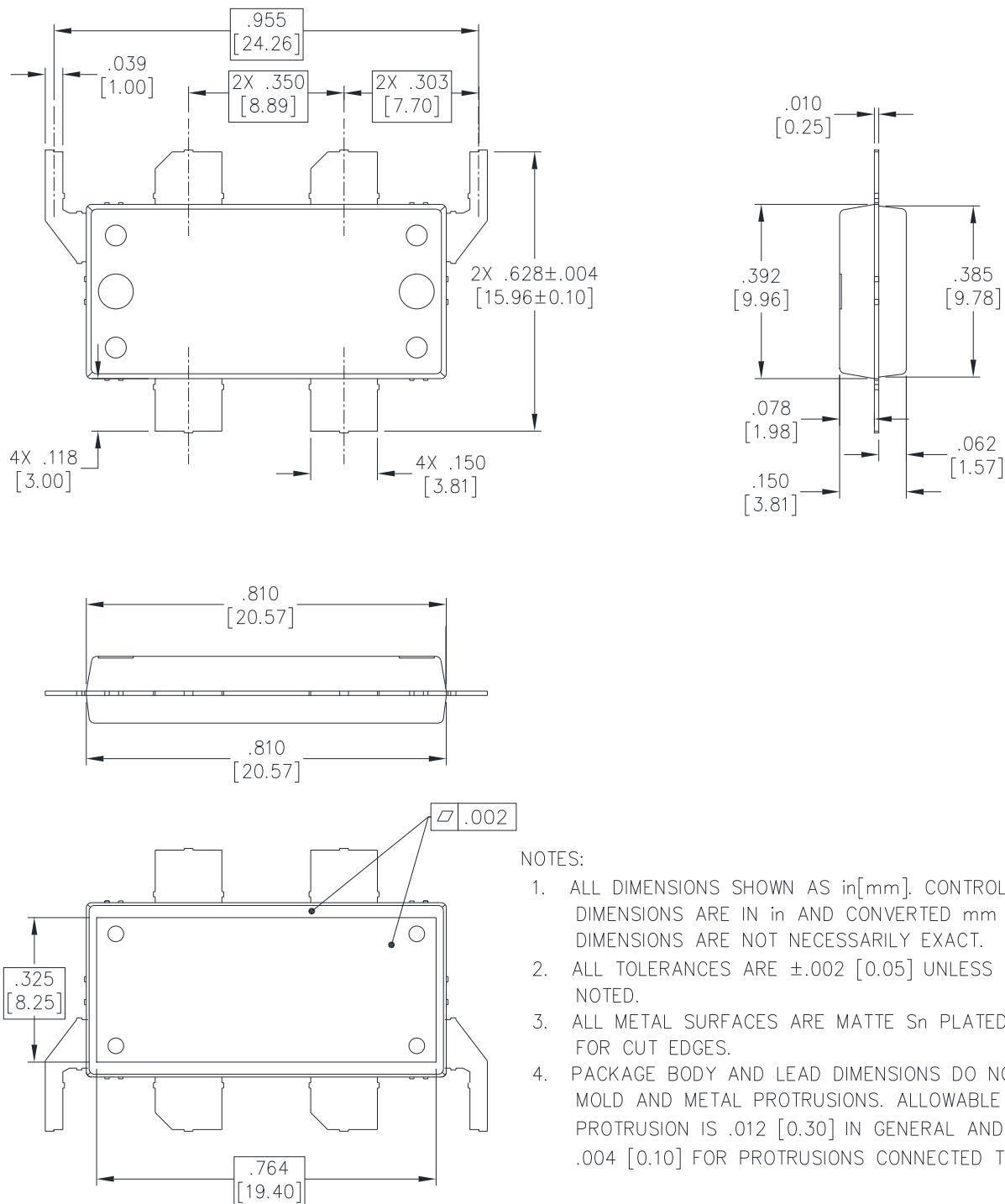
**Handling Procedures**

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  $\pm .002$  [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

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