High Power RF GaN Amplifier
130 W, 48 V, 1800 - 2200 MHz

MACOM PURE CARBIDE™

MAPC-C20130-CD
Rev. V1

Features

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

Applications

- Point-to-Point
- Infrastructure

Description

The MAPC-C20130-CD is a GaN on Silicon Carbide HEMT Amplifier designed for asymmetrical Doherty applications. The device is optimized for the frequency band of 1800 to 2200 MHz. Product is housed in an over-molded 7 x 6.5 mm DFN package.

Typical Doherty Performance:

V_{DS} = 48 V, I_{DQm} = 160 mA, V_{GSpk} = -4.9 V
P_{OUT} = 42.7 dBm, T_A = 25°C
Note: Performance in MACOM Doherty Application Fixture. Single Carrier- W-CDMA Channel Bandwidth 3.84 MHz, PAR 10dB @ 0.01% CCDF.

Frequency (MHz)	Gain (dB)	Efficiency (%)	Output PAR (dB)	ACPR (dBc)
1805	17.0	52.0	9.4	-28.0
1990	16.6	54.0	9.0	-31.0
2170	16.6	53.0	8.6	-34.0

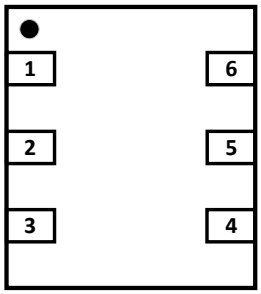
Ordering Information

Part Number	Package
MAPC-C20130-CD000	Bulk Quantity
MAPC-C20130-CDTR1	Tape and Reel[1]
MAPC-C20130-CDSB1	Sample Board, 1805-2200 MHz, tuned to 18.6 W
MAPC-C20130-CDSB4	Sample Board, 1805-2200 MHz, tuned to 5W

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

Functional Schematic

7.0 x 6.5 mm DFN



Pin Configuration

Pin #	Pin Name	Function
1	RF_{IN} / V_{G1}	RF Input / Gate (Main)
2,5	N/C	No Connection
3	RF_{IN} / V_{G2}	RF Input / Gate (Peak)
4	RF_{OUT} / V_{D2}	RF Output / Drain (Peak)
6	RF_{OUT} / V_{D1}	RF Output / Drain (Main)
7	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: Performance in MACOM Doherty Application Fixture

T_A = 25°C, V_{DS} = 48 V, I_{DQm} = 160 mA, V_{GSPK} = -4.9 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	2170 MHz, P_{OUT} = 42.7 dBm	Gp	—	16.6	—	dB
Drain Efficiency	2170 MHz, P_{OUT} = 42.7 dBm	η	—	53.0	—	%
Output CCDF @ 0.01%	2170 MHz, P_{OUT} = 42.7 dBm	PAR	—	8.6	—	dB
Adjacent Channel Power	2170 MHz, P_{OUT} = 42.7 dBm	ACP	—	-28.0	—	dBc
Input Return Loss	2170 MHz, P_{OUT} = 42.7 dBm	IRL	—	-19	—	dB
Gain Flatness	2170 MHz, P_{OUT} = 42.7 dBm	G_F	—	1.0	—	dB
Gain Variation (-25°C to +105°C)	2170 MHz, P_{OUT} = 42.7 dBm	ΔG	—	0.02	—	dB/°C
Power Variation (-25°C to +105°C)	2170 MHz, Pulsed 10% DC	ΔP_{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 Doherty Production Test Fixture

T_A = 25°C, V_{DS} = 48 V, I_{DQm} = 82 mA, V_{GSPK} = -4.5 V
Note: Performance in MACOM Doherty Production Test Fixture. LTE 20 MHz, PAR 8 dB @ 0.01% CCDF

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Power Gain	2170 MHz, P_{OUT} = 42.7 dBm	Gp	11.5	13.3	—	dB
Drain Efficiency	2170 MHz, P_{OUT} = 42.7 dBm	η	41.2	48.2	—	%
Output CCDF @ 0.01%	2170 MHz, P_{OUT} = 42.7 dBm	PAR	5.3	6.0	—	dB
Adjacent Channel Power	2170 MHz, P_{OUT} = 42.7 dBm	ACP	—	-27.9	-19.5	dBc

DC Electrical Characteristics: T_A = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Main Amplifier						
Drain-Source Breakdown Voltage	V_{GS} = -8 V, I_D = 3.28 mA	V_{BDS}	-	150	-	V
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{GLK}	-1.3	-	-	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 50 V	I_{GLK}	-1.9	-	-	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 8.2 mA	V_T	-3.8	-2.7	-2.1	V
Gate Quiescent Voltage	V_{DS} = 48 V, I_D = 82 mA	V_{GSQ}	-3.6	-3.2	-2.1	V
Peak Amplifier						
Drain-Source Breakdown Voltage	V_{GS} = -8 V, I_D = 5.52 mA	V_{BDS}	-	150	-	V
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{GLK}	-2.2	-	-	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 50 V	I_{GLK}	-3.2	-	-	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 10 mA	V_T	-3.8	-2.4	-2.03	V
Gate Quiescent Voltage	V_{DS} = 48 V, I_D = 138 mA	V_{GSQ}	-3.6	-3.2	-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 = 82 mA	V	-3.6	-3.2	-2.1

ESD Characteristics

Parameter	Class	Standard
Human Body Model (HBM)	1A	ANSI/ESDA/JEDEC JS-001
Charge Device Model (CDM)	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[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 (Main), I_G	8.2 mA
Gate Current (Peak), I_G	13.8 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

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} < 55V will ensure MTTF > 2.51 x 10^6 hours.
8. Operating at nominal conditions with T_{CH} ≤ 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 Finite Element Analysis	V_{DS} = 48 V T_C=85°C,T_{CH} = 225°C	R_{θ}(FEA)	4.1	°C/W
Thermal Resistance using Infrared Measurement of Die Surface Temperature	V_{DS} = 48 V T_C=85°C,T_{CH} = 225°C	R_{θ}(IR)	2.9	°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

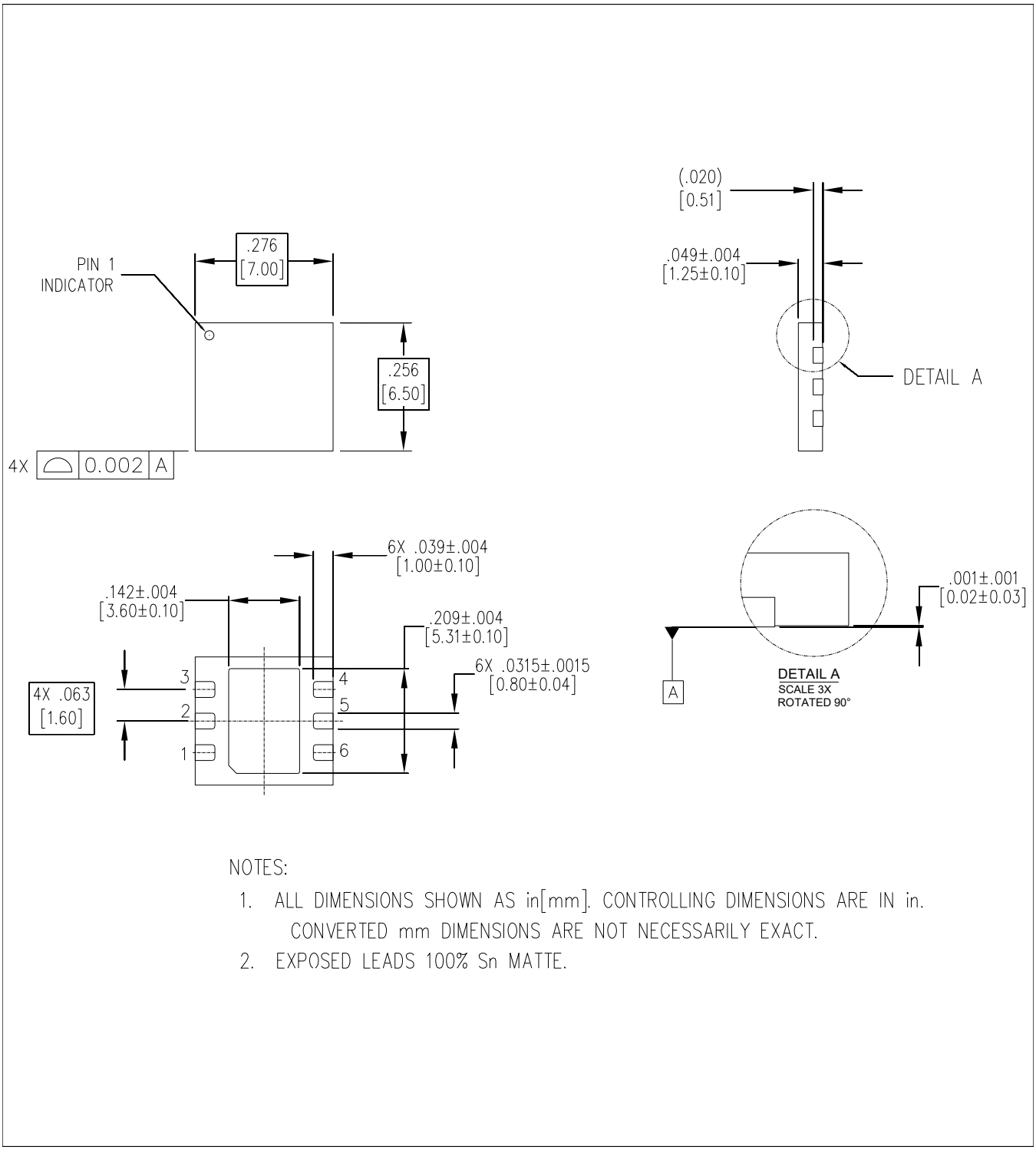
Handling Procedures

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.

7.0 x 6.5 mm 6-Lead Package Dimensions



NOTES:

1. ALL DIMENSIONS SHOWN AS in[mm]. CONTROLLING DIMENSIONS ARE IN in. CONVERTED mm DIMENSIONS ARE NOT NECESSARILY EXACT.
2. EXPOSED LEADS 100% Sn MATTE.