

GaN on SiC HEMT Power Transistor 14 W, DC - 2.5 GHz, CW Power

Rev. V2

Features

- GaN on SiC Depletion Mode Transistor
- Common-Source Configuration
- Broadband Class AB Operation
- Thermally Enhanced Cu/W Package
- RoHS* Compliant
- +50V Typical Operation
- MTTF = 600 years ($T_J < 200^\circ\text{C}$)

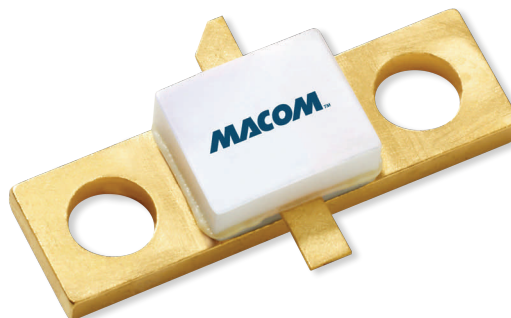
Primary Applications

- RF Lighting
- RF Plasma Generation
- RF Heating
- RF Drying
- Material Processing
- Power Industrial Equipment
- ISM
- Broadcast
- MILCOM
- Datalinks
- Air Traffic Control Radar - Commercial
- Weather Radar - Commercial
- Military Radar - Military

Description

The MAGX-000245-014000 is a gold metalized unmatched Gallium Nitride (GaN) on Silicon Carbide (SiC) RF power transistor suitable for CW applications centered at 2.45GHz for application in ISM/Broadcast/Plasma applications. This product differentiates itself from other GaN power transistors in that it runs well in CW. The matching network is compact and small. The frequency of operation covers DC - 2.5 GHz which captures commercial as well as military applications. This product is designed as a high power driver amplifier or final stage depending on the application. Using state of the art wafer fabrication processes, these high performance transistors provide high gain, efficiency, bandwidth and ruggedness over a wide bandwidth for today's demanding application needs. The MAGX-000245-014000 is constructed using a thermally enhanced Cu/W flanged ceramic package which provides excellent thermal performance.

MAGX-000245-014000



Ordering Information

Part Number	Description
MAGX-000245-014000	Bulk Packaging
MAGX-S00245-014000	Sample Board (2.45 GHz)

1 * Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

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Electrical Specifications¹: Freq. = 2450 MHz, T_A = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
RF Functional Tests: V_{DD} = +50 V, I_{DQ} = 15 mA, CW Operation						
Input Power	P _{OUT} = 14 W	P _{IN}	-	0.43	0.58	W
Power Gain	P _{OUT} = 14 W	G _P	13.8	15.2	-	dB
Drain Efficiency	P _{OUT} = 14 W	η _D	55	57	-	%
2 nd Harmonics	P _{OUT} = 14 W	2Fc	-	-50	-	dBc
3 rd Harmonics	P _{OUT} = 14 W	3Fc	-	-49	-	dBc
Load Mismatch Stability	P _{OUT} = 14 W	VSWR-S	-	5:1	-	-
Load Mismatch Tolerance	P _{OUT} = 14 W	VSWR-T	-	10:1	-	-

Electrical Characteristics: T_A = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
DC Characteristics						
Drain-Source Leakage Current	V _{GS} = -8 V, V _{DS} = 175 V	I _{DS}	-	-	750	μA
Gate Threshold Voltage	V _{DS} = 5 V, I _D = 2 mA	V _{GS(TH)}	-5	-3	-2	V
Forward Transconductance	V _{DS} = 5 V, I _D = 500 mA	G _M	0.35	-	-	S
Dynamic Characteristics						
Input Capacitance	V _{DS} = 0 V, V _{GS} = -8 V, F = 1 MHz	C _{ISS}	-	4.4	-	pF
Output Capacitance	V _{DS} = 50 V, V _{GS} = -8 V, F = 1 MHz	C _{OSS}	-	1.9	-	pF
Reverse Transfer Capacitance	V _{DS} = 50 V, V _{GS} = -8 V, F = 1 MHz	C _{RSS}	-	0.2	-	pF

Correct Device Sequencing
Turning the device ON

1. Set V_{GS} to the pinch-off (V_P), typically -5 V.
2. Turn on V_{DS} to nominal voltage (+50V).
3. Increase V_{GS} until the I_{DS} current is reached.
4. Apply RF power to desired level.

Turning the device OFF

1. Turn the RF power off.
2. Decrease V_{GS} down to V_P.
3. Decrease V_{DS} down to 0 V.
4. Turn off V_{GS}.

1. Electrical Specifications measured in MACOM RF evaluation board.

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Absolute Maximum Ratings^{2,3,4}

Parameter	Limit
Supply Voltage (V_{DD})	+65 V
Supply Voltage (V_{GG})	-8 to 0 V
Supply Current ($I_{D(MAX)}$) for CW Operation at $V_{DD} = +65$ V	800 mA
Input Power (P_{IN}) for CW Operation at $V_{DD} = +50$ V	P_{IN} (nominal) + 3 dB
Absolute Max. Junction/Channel Temperature	200°C
Power Dissipation at 85°C for CW Operation at $V_{DD} = +50$ V	11.2 W
MTTF ($T_J < 200^\circ\text{C}$)	600 years
Thermal Resistance, ($T_J = 200^\circ\text{C}$) $V_{DD} = 50$ V, $I_{DQ} = 15$ mA, CW Operation	8.5°C/W
Operating Temperature	-40 to +95°C
Storage Temperature	-65 to +150°C
Mounting Temperature	See solder reflow profile
ESD Min. - Charged Device Model (CDM)	150 V
ESD Min. - Human Body Model (HBM)	500 V

2. Operation of this device above any one of these parameters may cause permanent damage.

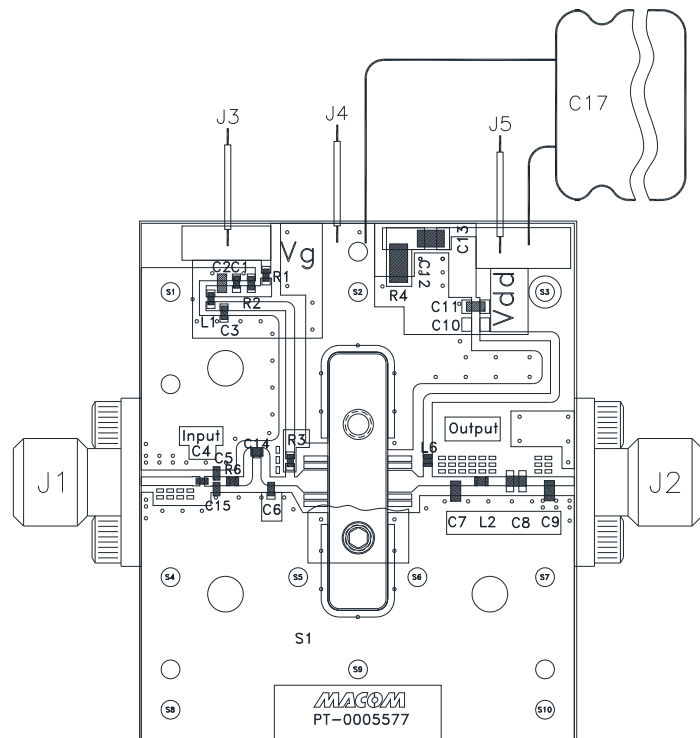
3. Channel temperature directly affects a device's MTTF. Channel temperature should be kept as low as possible to maximize lifetime.

4. For saturated performance it is recommended that the sum of $(3 \cdot V_{DD} + \text{abs}(V_{GG})) < 175$ V.

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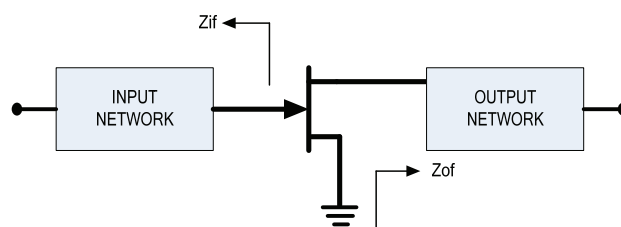
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Test Fixture Assembly (2450 MHz, CW Operation)



Test Fixture Impedances

F (MHz)	Z _{IF} (Ω)	Z _{OF} (Ω)
2450	0.7 + j1.0	17.9 + j15.5



Parts List

Reference Designator	Part	Vendor
C1	0402, 0.1 μF, X7R, 10%, 16 V	Murata
C2	0402, 10 nF, X7R, 10%, 50 V	Murata
C13	0805, 0.1 μF, X7R, 10%, 100 V	TDK
C3, C4	0402, 12 pF, ±1%, 200 V	ATC
C8, C11	0603, 12 pF, ±2%, 250 V	ATC
C5, C15	0402, 2.2 pF, ±0.1 pF, 200 V	ATC
C6	0402, 3.9 pF, ±0.1 pF, 200 V	ATC
C7	0603, 2.4 pF, ±0.05 pF, 250 V	ATC
C17	100 μF, 160 V, Electrolytic Capacitor	Panasonic
C9	0603, 1.5 pF, ±0.05 pF, 250 V	ATC
C10, C12	Do Not Populate	-
L1	10 nH, 0402, 2%	Coilcraft
R1	200 Ω, 0402, 5%	Panasonic
R2	3 KΩ, 0402, 5%,	Panasonic
R3	11 Ω, 0402, 1%	Panasonic
R4	2.2 Ω, 1206, 1%	Panasonic
C14, L2, L6, R6	Copper Shorting Tab	MACOM
J1, J2	SMA Connector	Tyco Electronics

4 Contact factory for Gerber file or additional circuit information.

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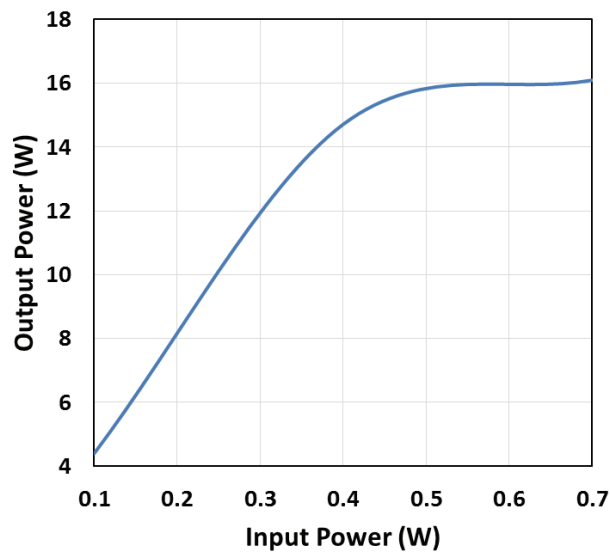
• **North America** Tel: 800.366.2266 / Fax: 978.366.2266
• **Europe** Tel: 44.1908.574.200 / Fax: 44.1908.574.300
• **Asia/Pacific** Tel: 81.44.844.8296 / Fax: 81.44.844.8298

Application Section

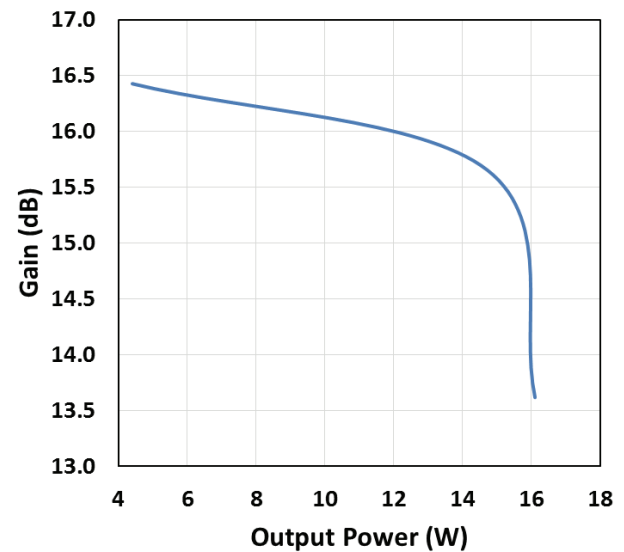
Typical Performance Curves

2450 MHz, $V_{DD} = 50$ V, $I_{DQ} = 15$ mA, CW Operation, $T_A = 25^\circ\text{C}$

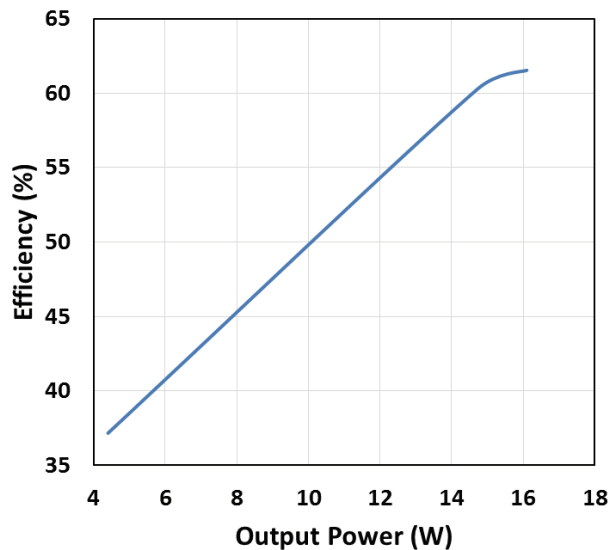
Output Power vs. Input Power



Gain vs. Output Power



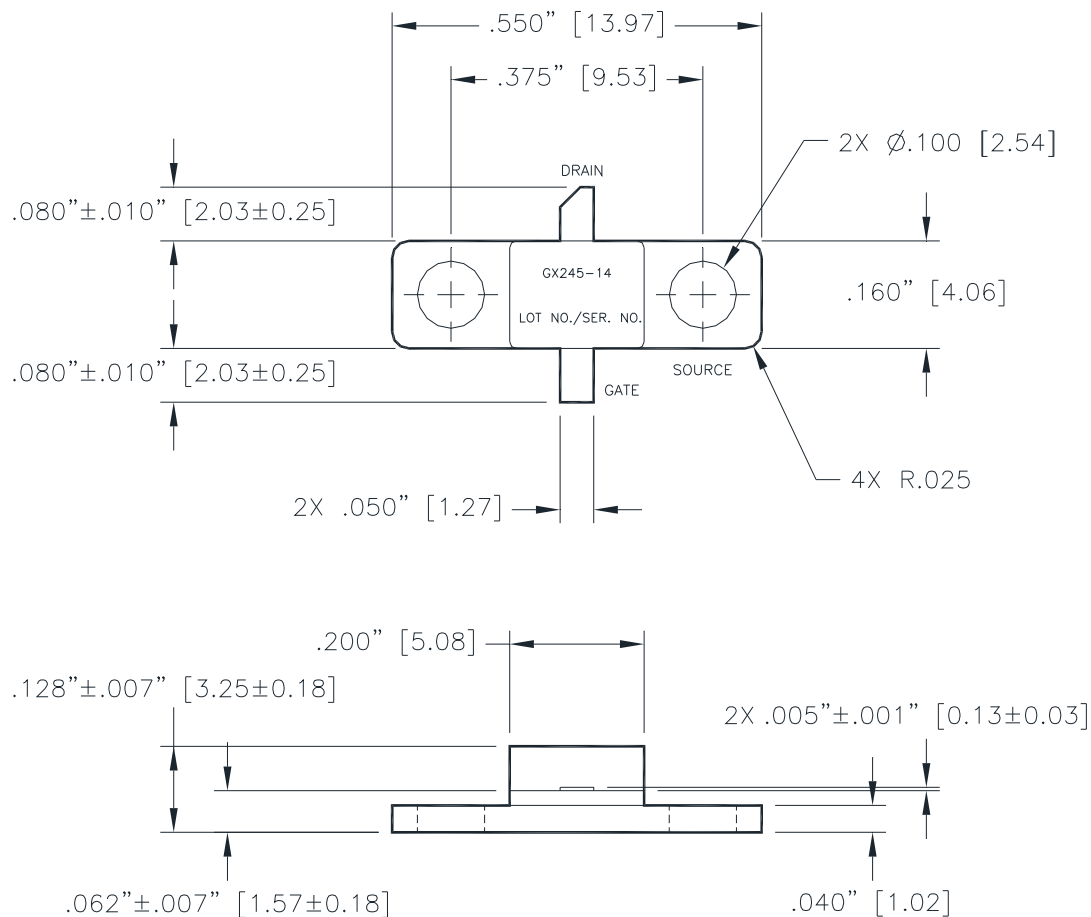
Drain Efficiency vs. Output Power



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Outline Drawing MAGX-000245-014000



Unless otherwise noted, tolerances are inches ± 0.005 [millimeters ± 0.13 mm]

LEAD TRIMMING INSTRUCTIONS

N/A

MARKING INSTRUCTIONS

LOT NO./SER NO. is LLLLLSSS
Where LLLLL = last 5 digits of lot and
SSS = last 3 digits of serial number.