

# MAGX-000025-150000



**GaN on SiC HEMT Power Transistor**  
**150 W, 1-2500 MHz**

Rev. V1

## Features

- GaN on SiC Transistor Technology
- Broadband Unmatched Transistor
- Common-Source Configuration
- +50 V Typical Operation
- Class AB Operation
- RoHS\* Compliant and 260°C Reflow Compatible
- MTTF = 600 years ( $T_J < 200\text{ }^\circ\text{C}$ )

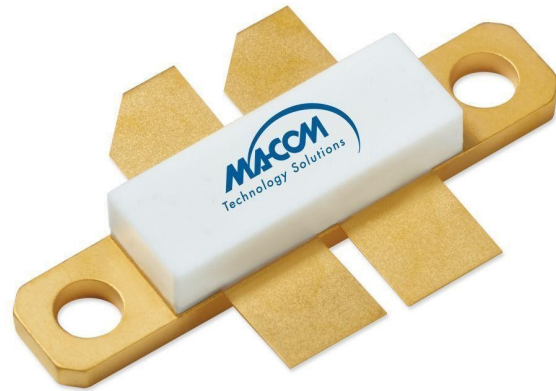
## Applications

- General purpose for pulsed or CW applications

## Description

The MAGX-000025-150000 is a gold-metalized Gallium Nitride (GaN) on Silicon Carbide (SiC) RF power transistor suitable for a variety of RF power amplifier applications. 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. High breakdown voltages allow for reliable and stable operation under more extreme mismatch load conditions compared with older semiconductor technologies.

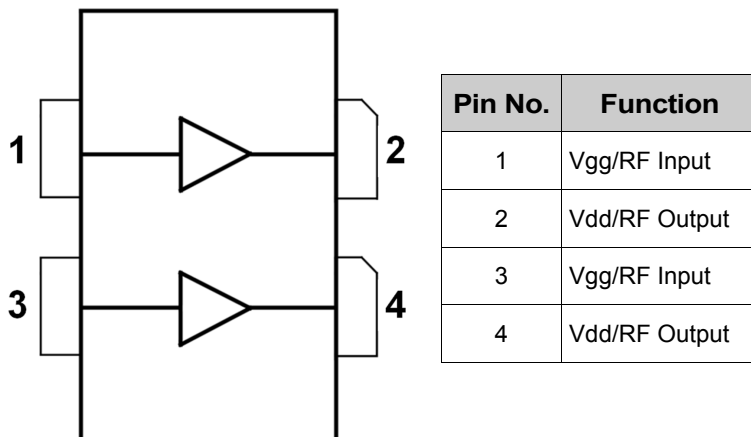
## MAGX-000025-150000



## Ordering Information

Part Number	Description
MAGX-000025-150000	Flanged
MAGX-000025-SB2PPR	1200-1400 MHz Evaluation Board
MAGX-000025-SB1PPR	2500 MHz Evaluation Board

## Functional Schematic



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

## GaN on SiC HEMT Power Transistor 150 W, 1-2500 MHz

Rev. V1

### Electrical Specifications<sup>1</sup>: Freq. = 1200-1400 MHz, T<sub>A</sub> = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
<b>RF Functional Tests: V<sub>DD</sub> = 50 V, I<sub>DQ</sub> = 600 mA, 300 μs Pulse, 20% Duty</b>						
Output Power	P <sub>IN</sub> = 2.5 W	P <sub>OUT</sub>	150	170	-	W
Power Gain	P <sub>IN</sub> = 2.5 W	G <sub>P</sub>	17.5	18	-	dB
Drain Efficiency	P <sub>IN</sub> = 2.5 W	η <sub>D</sub>	52	58	-	%
Droop	P <sub>IN</sub> = 2.5 W	Droop	-	0.2	0.3	dB
Load Mismatch Stability	P <sub>IN</sub> = 2.5 W	VSWR-S	-	5:1	-	-
Load Mismatch Tolerance	P <sub>IN</sub> = 2.5 W	VSWR-T	-	10:1	-	-

### Typical RF Characteristics<sup>2</sup>: Freq. = 2500 MHz, T<sub>A</sub> = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
<b>RF Functional Tests: V<sub>DD</sub> = 50 V, I<sub>DQ</sub> = 600 mA, 300 μs Pulse, 20% Duty</b>						
Output Power	P <sub>IN</sub> = 7 W	P <sub>OUT</sub>	-	125	-	W
Power Gain	P <sub>IN</sub> = 7 W	G <sub>P</sub>	-	12.5	-	dB
Drain Efficiency	P <sub>IN</sub> = 7 W	η <sub>D</sub>	-	48	-	%
Droop	P <sub>IN</sub> = 7 W	Droop	-	0.1	-	dB
Load Mismatch Stability	P <sub>IN</sub> = 7 W	VSWR-S	-	5:1	-	-
Load Mismatch Tolerance	P <sub>IN</sub> = 7 W	VSWR-T	-	10:1	-	-
<b>RF Functional Tests: V<sub>DD</sub> = 28 V, I<sub>DQ</sub> = 600 mA, CW</b>						
Input Power	P <sub>OUT</sub> = 35 W	P <sub>IN</sub>	-	2	-	W
Power Gain	P <sub>OUT</sub> = 35 W	G <sub>P</sub>	-	12	-	dB
Drain Efficiency	P <sub>OUT</sub> = 35 W	η <sub>D</sub>	-	45	-	%
Load Mismatch Stability	P <sub>OUT</sub> = 35 W	VSWR-S	-	5:1	-	-
Load Mismatch Tolerance	P <sub>OUT</sub> = 35 W	VSWR-T	-	10:1	-	-

### Electrical Characteristics<sup>3</sup>: T<sub>A</sub> = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
<b>DC Characteristics (Per Side):</b>						
Drain-Source Leakage Current	V <sub>GS</sub> = -8 V, V <sub>DS</sub> = 175 V	I <sub>DS</sub>	-	2	5.28	mA
Gate Threshold Voltage	V <sub>DS</sub> = 5 V, I <sub>D</sub> = 75 mA	V <sub>GS(TH)</sub>	-5	-3.1	-2	V
Forward Transconductance	V <sub>DS</sub> = 5 V, I <sub>D</sub> = 17.5 mA	G <sub>M</sub>	2	2.8	-	S
<b>Dynamic Characteristics (Per Side):</b>						
Input Capacitance	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = -8 V, F = 1 MHz	C <sub>ISS</sub>	-	26.4	-	pF
Output Capacitance	V <sub>DS</sub> = 50 V, V <sub>GS</sub> = -8 V, F = 1 MHz	C <sub>OSS</sub>	-	11.2	-	pF
Reverse Transfer Capacitance	V <sub>DS</sub> = 50 V, V <sub>GS</sub> = -8 V, F = 1 MHz	C <sub>RSS</sub>	-	1	-	pF

1. Electrical Specifications measured in MACOM RF evaluation board.

2. Typical RF Characteristics measured in MACOM RF evaluation board.

3. All DC Characteristics are per side.

2

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.macomtech.com](http://www.macomtech.com) for additional data sheets and product information.

- 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

## GaN on SiC HEMT Power Transistor 150 W, 1-2500 MHz

Rev. V1

### Absolute Maximum Ratings<sup>4,5,6,7,8</sup>

Parameter	Limit
Supply Voltage ( $V_{DD}$ )	+65 V
Supply Voltage ( $V_{GS}$ )	-8 to -2 V
Supply Current ( $I_{D_{MAX}}$ ) for CW operation at $V_{DD} = 28$ V	5.5 A
Supply Current ( $I_{D_{MAX}}$ ) for pulsed operation at $V_{DD} = 50$ V	8.3 A
Input Power ( $P_{IN}$ ) for CW operation at $V_{DD} = 28$ V	$P_{IN}$ (typical) + 1.5 dB
Input Power ( $P_{IN}$ ) for pulsed operation at $V_{DD} = 50$ V	40 dBm
Absolute Max. Junction/Channel Temperature	200°C
Power Dissipation at 85 °C for CW operation at $V_{DD} = 28$ V	79 W
Power Dissipation at 85 °C for pulsed operation at $V_{DD} = 50$ V	177 W
Thermal Resistance, ( $T_J = 200$ °C) $V_{DD} = 28$ V, $I_{DQ} = 600$ mA, $P_{out} = 35$ W, CW	1.45 °C/W
Thermal Resistance, ( $T_J = 200$ °C) $V_{DD} = 50$ V, $I_{DQ} = 600$ mA, $P_{in} = 7$ W, pulsed	0.65 °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)	300 V
ESD Min. - Human Body Model (HBM)	700 V

4. Operation of this device above any one of these parameters may cause permanent damage.
5. For CW operation, Input Power limit is +1.5 dB over nominal drive required to achieve  $P_{OUT} = 35$  W.
6. Channel temperature directly affects a device's MTTF. Channel temperature should be kept as low as possible to maximize lifetime.
7. For saturated performance it is recommended that the sum of  $(3 \cdot V_{DD} + \text{abs}(V_{GG})) < 175$  V.
8. Pulsed operation is specified for a 300  $\mu$ s Pulse, 20% Duty.

## Test Fixture Impedances (Per Side)

F (MHz)	Z <sub>IF(1,2)</sub> (Ω)	Z <sub>OF(1,2)</sub> (Ω)
1200	0.8 + j0.5	9.4 + j4.1
1300	0.9 + j0.2	7.2 + j3.0
1400	0.5 - j0.2	5.4 + j3.4
2500	1.2 - j3.4	3.1 + j1.4

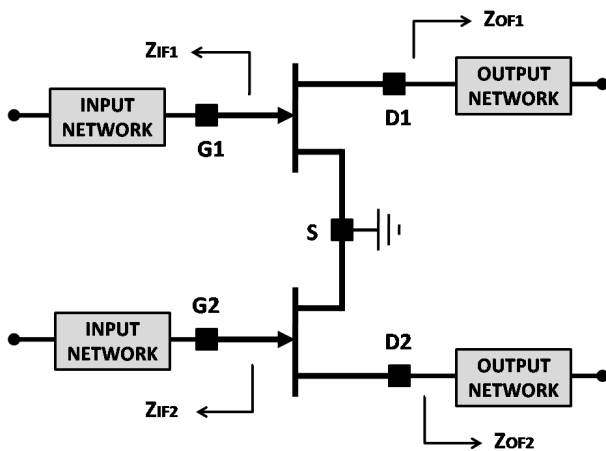
## Correct Device Sequencing

### 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:  
 [(300  $\mu$ s, 20%) = 50 V; (2.5 GHz, CW) = 28 V].
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  $V_{GS}$ .



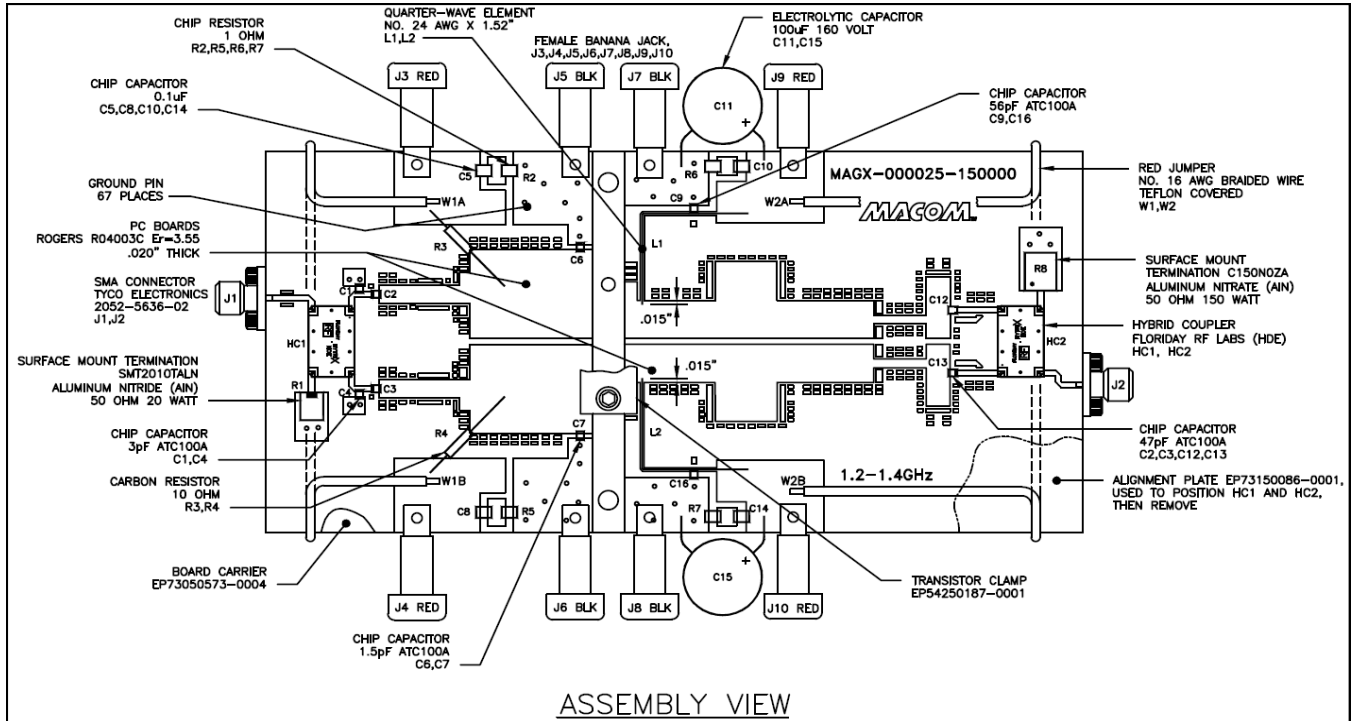
# MAGX-00025-150000



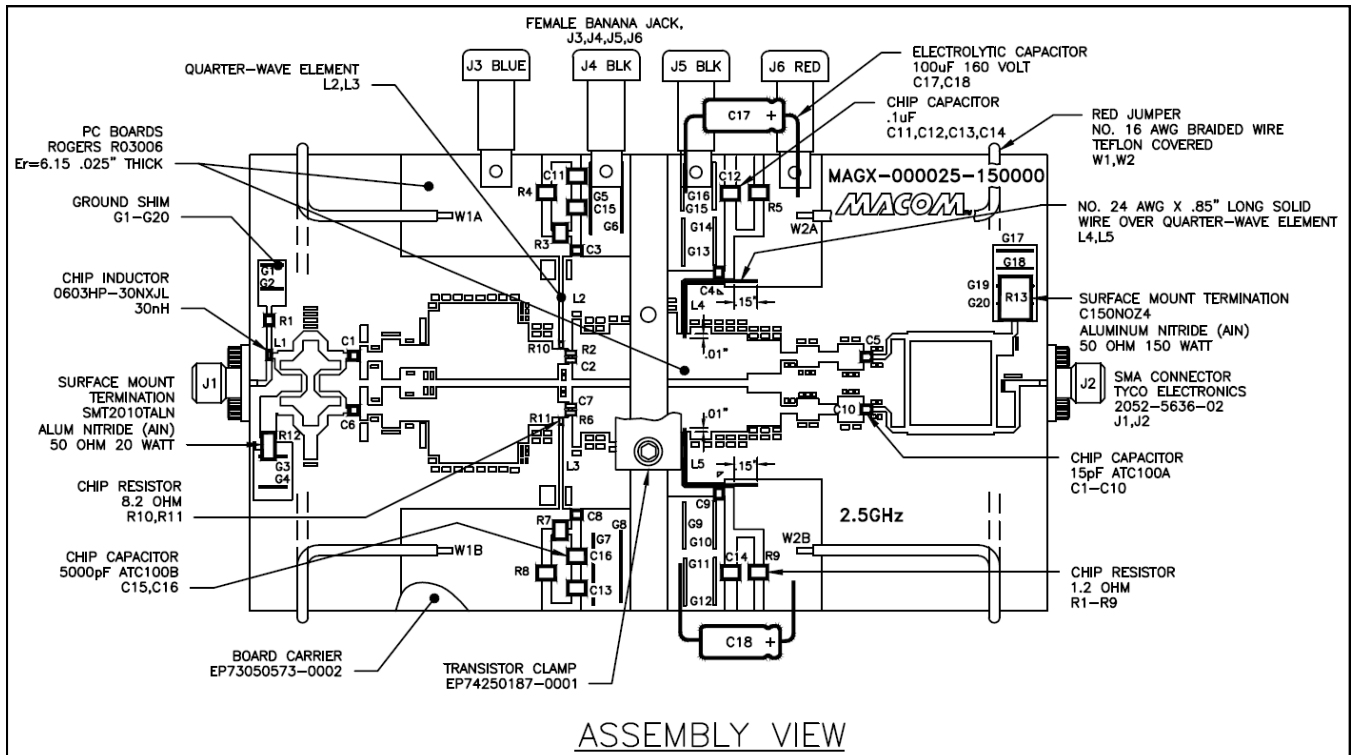
GaN on SiC HEMT Power Transistor  
150 W, 1-2500 MHz

Rev. V1

## Test Fixture Assembly (1200-1400 MHz)



## Test Fixture Assembly (2500 MHz)



5

M/A-COM 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.macomtech.com](http://www.macomtech.com) for additional data sheets and product information.

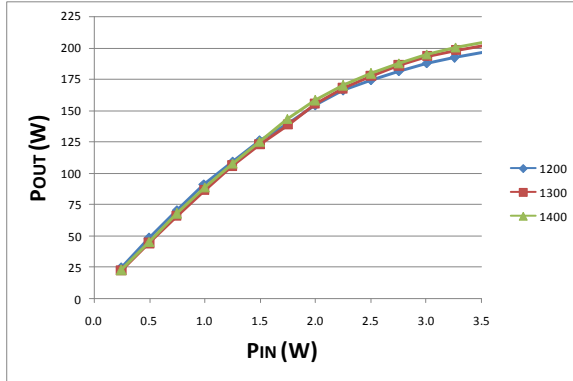
- North America Tel: 800.366.2266 / Fax: 978.366.2266
- Europe Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- Asia/Pacific Tel: 81.44.844.8296 / Fax: 81.44.844.8298

## Application Section

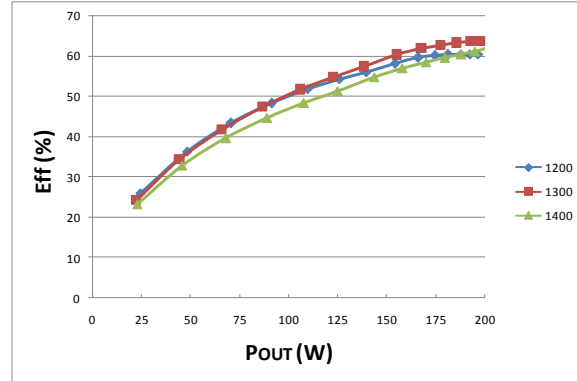
### Typical Performance Curves

**1200-1400 MHz, 300  $\mu$ s Pulse, 20% Duty,  $V_{DD} = 50$  V,  $I_{dq} = 600$  mA**

Output Power Vs. Input Power

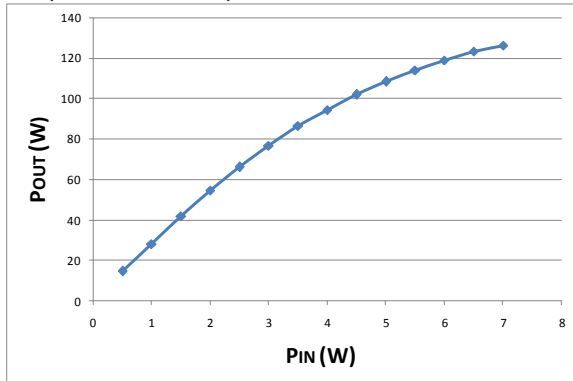


Drain Efficiency Vs. Output Power

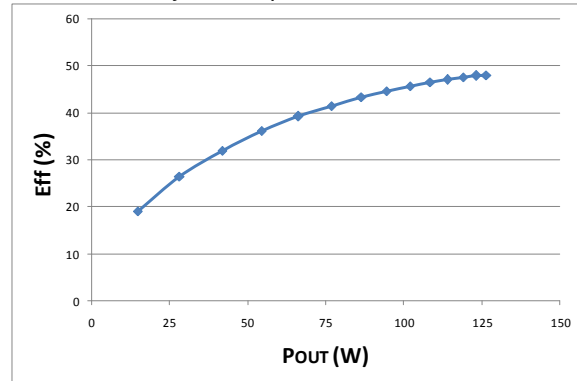


**2500 MHz, 300  $\mu$ s Pulse, 20% Duty,  $V_{DD} = 50$  V,  $I_{dq} = 600$  mA**

Output Power Vs. Input Power

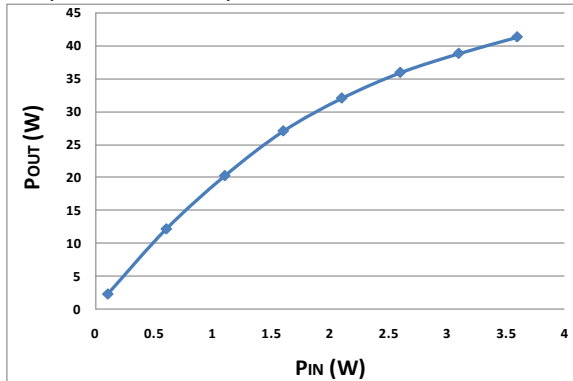


Drain Efficiency Vs. Output Power

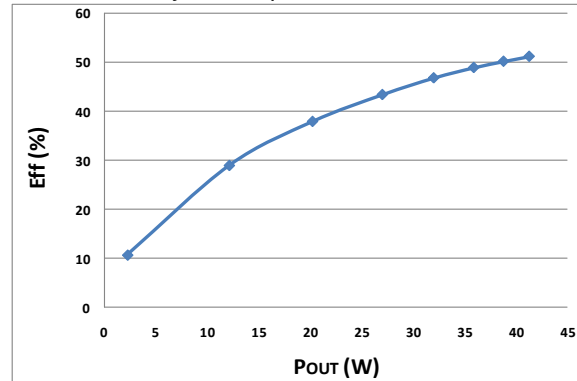


**2500 MHz, CW,  $V_{DD} = 28$  V,  $I_{dq} = 600$  mA**

Output Power Vs. Input Power



Drain Efficiency Vs. Output Power



# MAGX-000025-150000



GaN on SiC HEMT Power Transistor  
150 W, 1-2500 MHz

Rev. V1

## Outline Drawing MAGX-000025-150000

