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 °C)

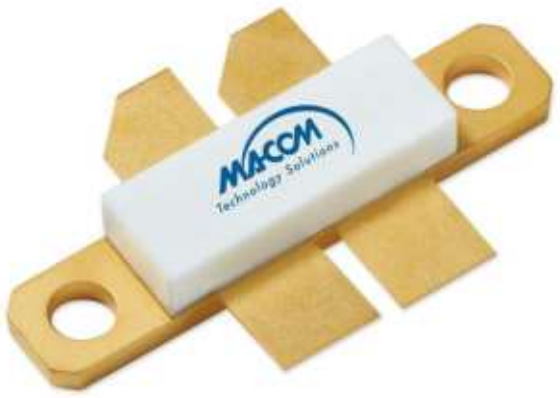
Applications

- 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.

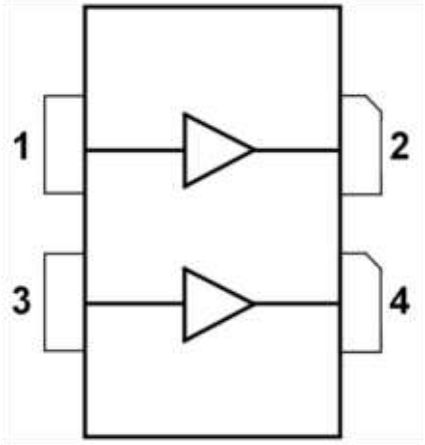
MAGX-000025-150000



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



Pin No.	Function
1	Vgg/RF Input
2	Vdd/RF Output
3	Vgg/RF Input
4	Vdd/RF Output

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

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Electrical Specifications[1]: Freq. = 1200-1400 MHz, T_A = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
RF Functional Tests: V_{DD} = 50 V, I_{DQ} = 600 mA, 300 µs Pulse, 20% Duty						
Output Power	P_{IN}= 2.5 W	P_{OUT}	150	170	-	W
Power Gain	P_{IN}= 2.5 W	G_P	17.5	18	-	dB
Drain Efficiency	P_{IN}= 2.5 W	η_D	52	58	-	%
Droop	P_{IN}= 2.5 W	Droop	-	0.2	0.3	dB
Load Mismatch Stability	P_{IN}= 2.5 W	VSWR-S	-	5:1	-	-
Load Mismatch Tolerance	P_{IN}= 2.5 W	VSWR-T	-	10:1	-	-

Typical RF Characteristics[2]: Freq. = 2500 MHz, T_A = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
RF Functional Tests: V_{DD} = 50 V, I_{DQ} = 600 mA, 300 µs Pulse, 20% Duty						
Output Power	P_{IN}= 7 W	P_{OUT}	-	125	-	W
Power Gain	P_{IN}= 7 W	G_P	-	12.5	-	dB
Drain Efficiency	P_{IN}= 7 W	η_D	-	48	-	%
Droop	P_{IN}= 7 W	Droop	-	0.1	-	dB
Load Mismatch Stability	P_{IN}= 7 W	VSWR-S	-	5:1	-	-
Load Mismatch Tolerance	P_{IN}= 7 W	VSWR-T	-	10:1	-	-
RF Functional Tests: V_{DD} = 28 V, I_{DQ} = 600 mA, CW						
Input Power	P_{OUT}= 35 W	P_{IN}	-	2	-	W
Power Gain	P_{OUT}= 35 W	G_P	-	12	-	dB
Drain Efficiency	P_{OUT}= 35 W	η_D	-	45	-	%
Load Mismatch Stability	P_{OUT}= 35 W	VSWR-S	-	5:1	-	-
Load Mismatch Tolerance	P_{OUT}= 35 W	VSWR-T	-	10:1	-	-

Electrical Characteristics[3]: T_A = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
DC Characteristics (Per Side):						
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 175 V	I_{DS}	-	2	5.28	mA
Gate Threshold Voltage	V_{DS} = 5 V, I_D = 75 mA	$V_{GS\ (TH)}$	-5	-3.1	-2	V
Forward Transconductance	V_{DS} = 5 V, I_D = 17.5 mA	G_M	2	2.8	-	S
Dynamic Characteristics (Per Side):						
Input Capacitance	V_{DS} = 0 V, V_{GS} = -8 V, F = 1 MHz	C_{ISS}	-	26.4	-	pF
Output Capacitance	V_{DS} = 50 V, V_{GS} = -8 V, F = 1 MHz	C_{OSS}	-	11.2	-	pF
Reverse Transfer Capacitance	V_{DS} = 50 V, V_{GS} = -8 V, F = 1 MHz	C_{RSS}	-	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.

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Absolute Maximum Ratings[4,5,6,7,8]

Parameter	Limit
Supply Voltage (V_{DD})	+65 V
Supply Voltage (V_{GS})	-8 to -2 V
Supply Current (I_{DMAX}) for CW operation at V_{DD} = 28 V	5.5 A
Supply Current (I_{DMAX}) 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	200ºC
Power Dissipation at 85 ºC for CW operation at V_{DD} = 28 V	79 W
Power Dissipation at 85 ºC for pulsed operation at V_{DD} = 50 V	177 W
Thermal Resistance, (T_J= 200 ºC) V_{DD} = 28 V, I_{DQ} = 600 mA, Pout = 35 W, CW	1.45 ºC/W
Thermal Resistance, (T_J= 200 ºC) V_{DD} = 50 V, I_{DQ} = 600 mA, Pin = 7 W, pulsed	0.65 ºC/W
Operating Temperature	-40 to +95ºC
Storage Temperature	-65 to +150ºC
Mounting Temperature	See solder reflow profile
ESD Min. - Charged Device Model (CDM)	300 V
ESD Min. - Human Body Model (HBM)	700 V

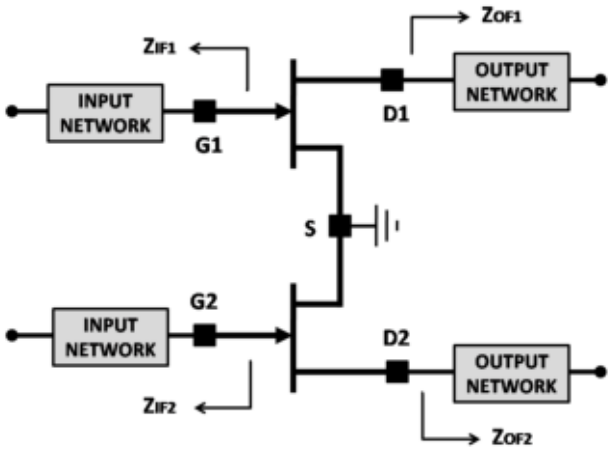
4. Operation of this device above any one of these parameters may cause permanent damage.
5. For CW operation, Input Power limit is +1.5 dB over nominal drive required to achieve P_{OUT} = 35 W.
6. Channel temperature directly affects a device's MTTF. Channel temperature should be kept as low as possible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

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Test Fixture Impedances (Per Side)

F (MHz)	$Z_{IF}(1,2)$ (Ω)	$Z_{OF}(1,2)$ (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 µs, 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.

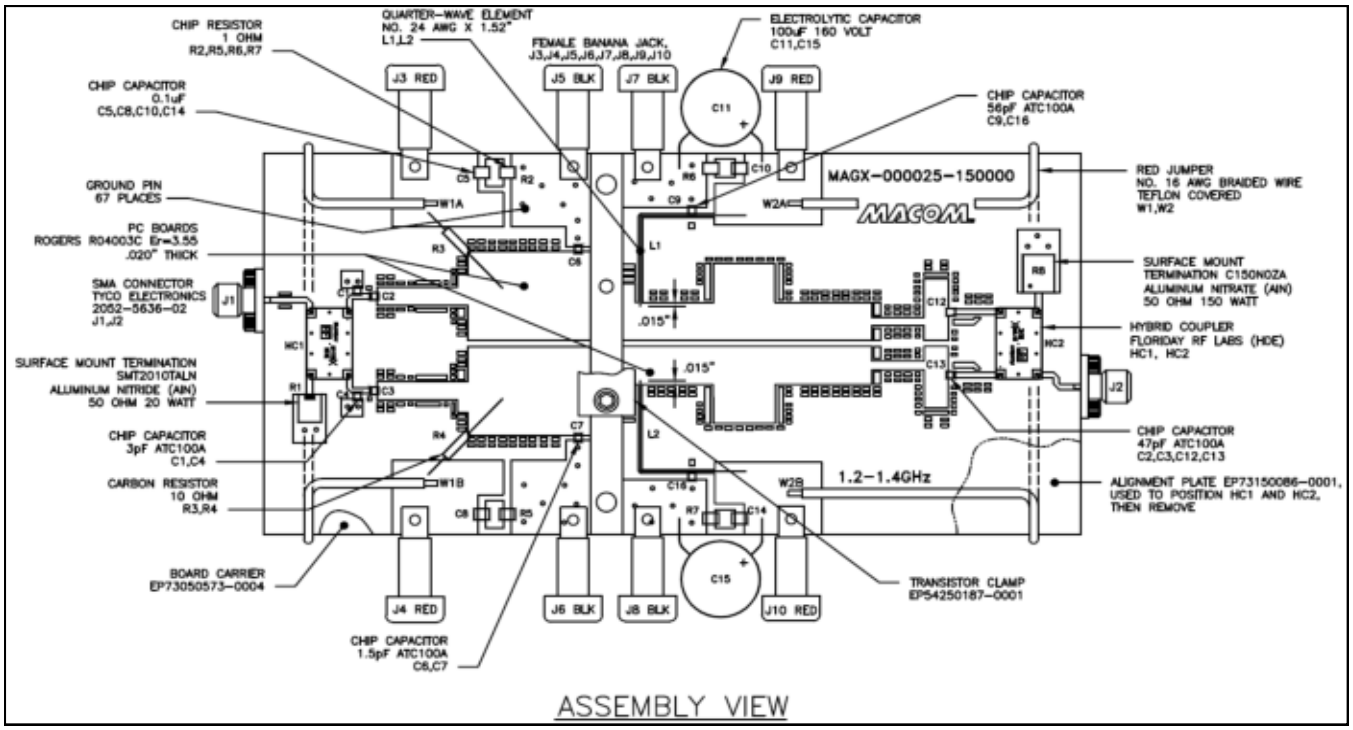
Turning the device OFF

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}

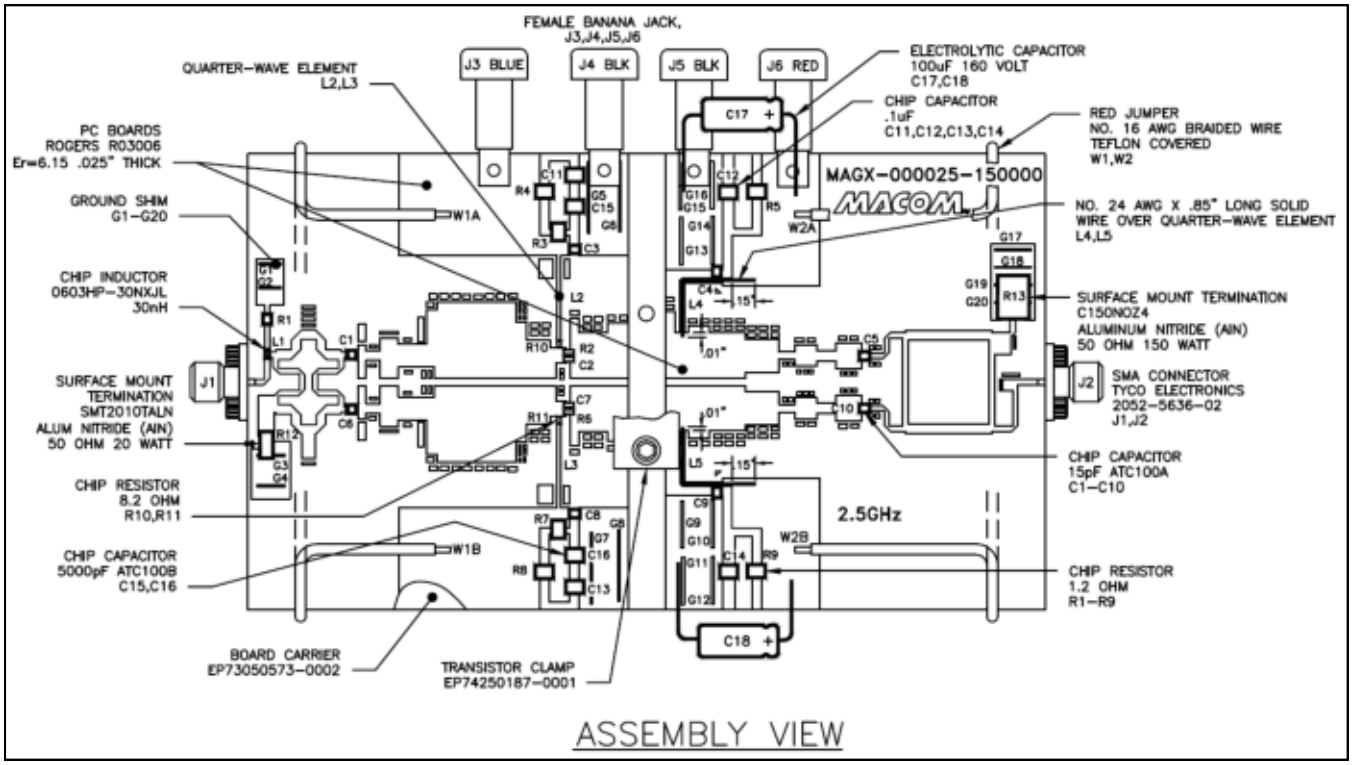
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Test Fixture Assembly (1200-1400 MHz)



Test Fixture Assembly (2500 MHz)



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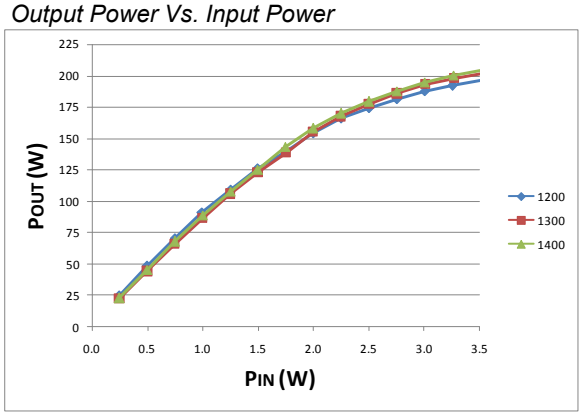
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Application Section

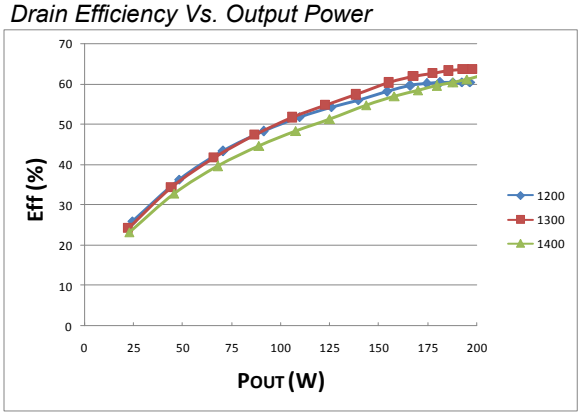
Typical Performance Curves

1200-1400 MHz, 300 µs Pulse, 20% Duty, V_{DD} = 50 V, Idq = 600 mA

Output Power Vs. Input Power

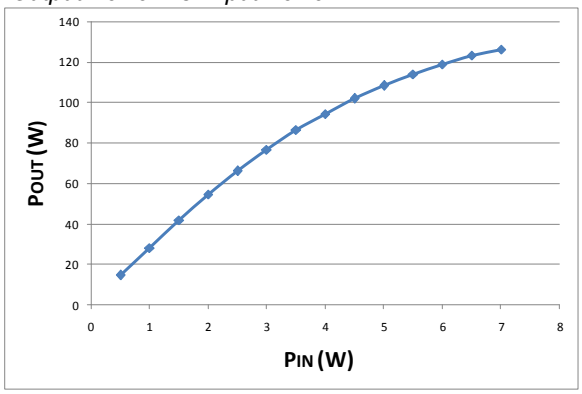


Drain Efficiency Vs. Output Power

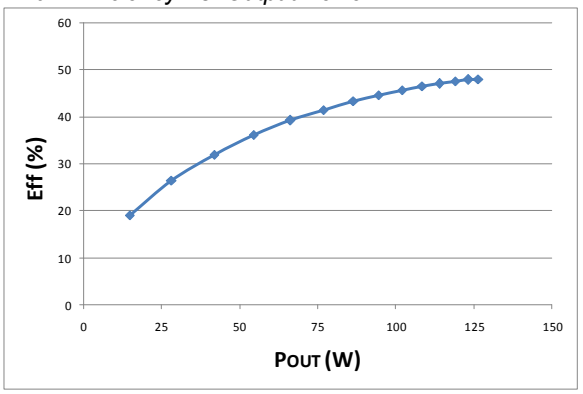


2500 MHz, 300 µs Pulse, 20% Duty, V_{DD} = 50 V, Idq = 600 mA

Output Power Vs. Input Power

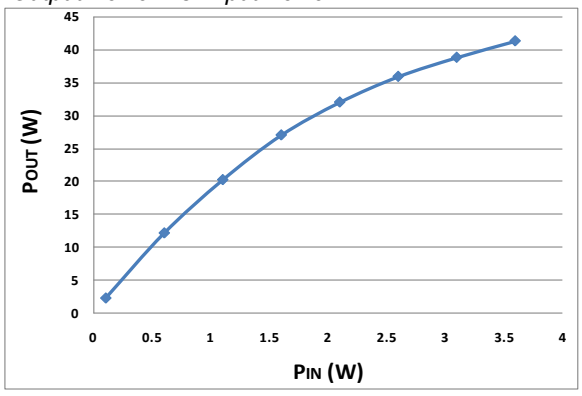


Drain Efficiency Vs. Output Power

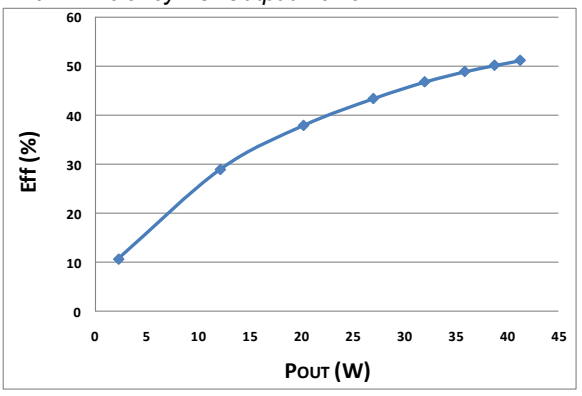


2500 MHz, CW, V_{DD} = 28 V, Idq = 600 mA

Output Power Vs. Input Power



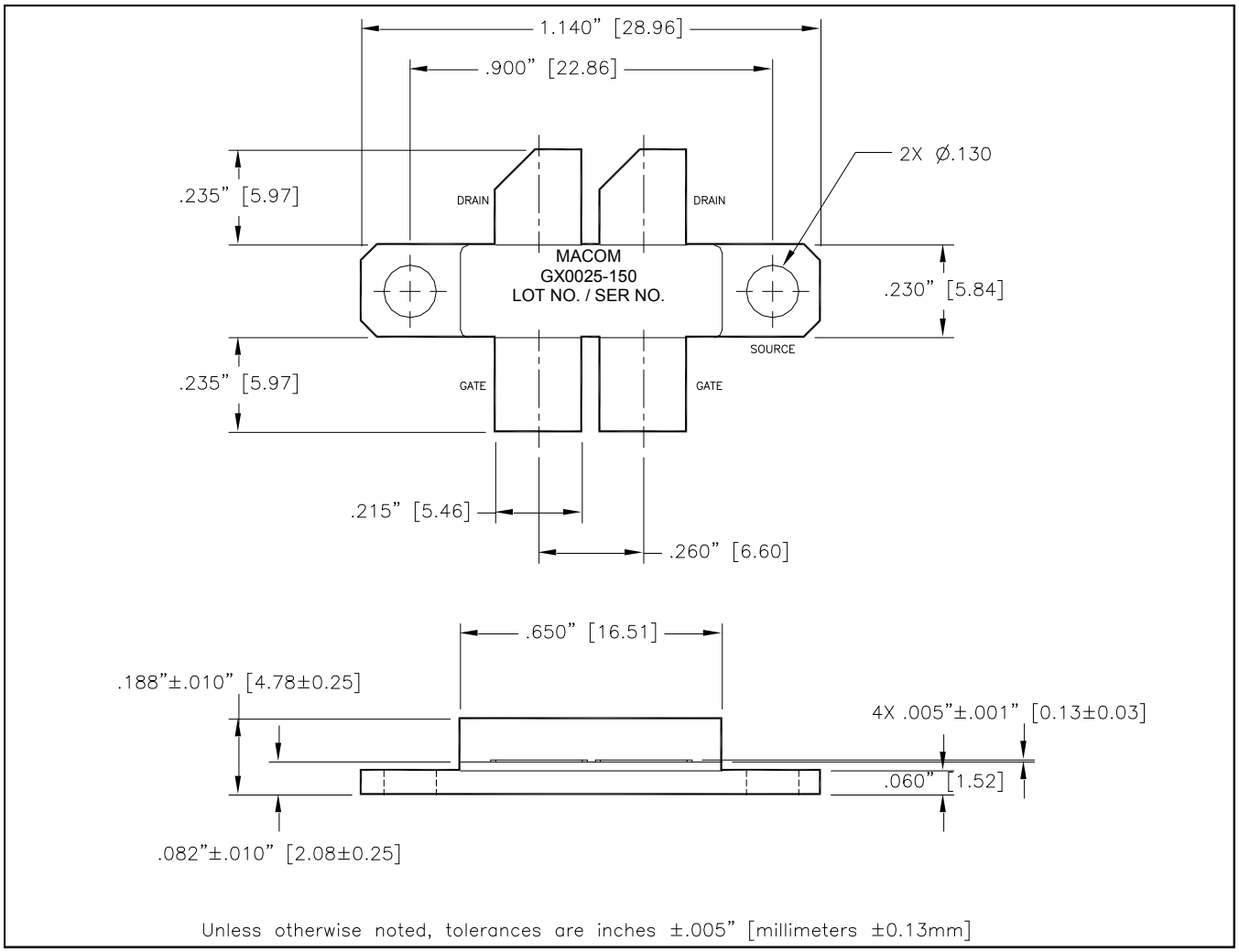
Drain Efficiency Vs. Output Power



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Outline Drawing MAGX-000025-150000



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