MAGX-000035-045000

GaN on SiC HEMT Pulsed Power Transistor
45 W Peak, DC-3500 MHz, 1 ms Pulse, 10% Duty

Rev. V2

Features

- GaN on SiC Depletion Mode Transistor
- Common-Source Configuration
- Broadband Class AB Operation
- Thermally Enhanced Cu/Mo/Cu Package
- RoHS* Compliant
- +50V Typical Operation
- MTTF = 600 years (T_J < 200°C)

Application

- Civilian and Military Pulsed Radar

Description

The MAGX-000035-045000 is a gold metalized unmatched Gallium Nitride (GaN) on Silicon Carbide (SiC) RF power transistor optimized for civilian and military radar pulsed applications between DC - 3500 MHz. 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-000035-045000 is constructed using a thermally enhanced Cu/Mo/Cu flanged ceramic package which provides excellent thermal performance. High breakdown voltages allow for reliable and stable operation in extreme mismatched load conditions unparalleled with older semiconductor technologies.

MAGX-000035-045000

Ordering Information

Part Number	Description
MAGX-000035-045000	Bulk Packaging
MAGX-S10035-045000	Sample Board (2.7 - 3.5 GHz)

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

Electrical Specifications[1]: Freq. = 2700-3500 MHz, T_A = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
RF Functional Tests: V_{DD} = 50 V, I_{DQ} = 100 mA, 1 ms Pulse, 10% Duty						
Output Power	P_{IN}= 4 W	P_{OUT}	45	54	-	W
Power Gain	P_{IN}= 4 W	G_P	10.5	11.3	-	dB
Drain Efficiency	P_{IN}= 4 W	η_D	48	55	-	%
Input Return Loss	P_{IN}= 4 W	IRL	-	-8	-	dB
Load Mismatch Stability	P_{IN}= 4 W	VSWR-S	-	5:1	-	-
Load Mismatch Tolerance	P_{IN}= 4 W	VSWR-T	-	10:1	-	-

Electrical Specifications[1]: Freq. = 1030-1090 MHz, T_A = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
RF Functional Tests: V_{DD} = 50 V, I_{DQ} = 100 mA, 1 ms Pulse, 10% Duty						
Output Power	P_{IN}= 0.9 W	P_{OUT}	-	60	-	W
Power Gain	P_{IN}= 0.9 W	G_P	-	18	-	dB
Drain Efficiency	P_{IN}= 0.9 W	η_D	-	64	-	%
Input Return Loss	P_{IN}= 0.9 W	IRL	-	-8	-	dB
Load Mismatch Stability	P_{IN}= 0.9 W	VSWR-S	-	5:1	-	-
Load Mismatch Tolerance	P_{IN}= 0.9 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}	-	-	3.0	mA
Gate Threshold Voltage	V_{DS} = 5 V, I_D = 6 mA	$V_{GS\ (TH)}$	-5	-3	-2	V
Forward Transconductance	V_{DS} = 5 V, I_D = 1500 mA	G_M	1.1	-	-	S
Dynamic Characteristics						
Input Capacitance	V_{DS} = 0 V, V_{GS} = -8 V, F = 1 MHz	C_{ISS}	-	13.2	-	pF
Output Capacitance	V_{DS} = 50 V, V_{GS} = -8 V, F = 1 MHz	C_{OSS}	-	5.6	-	pF
Reverse Transfer Capacitance	V_{DS} = 50 V, V_{GS} = -8 V, F = 1 MHz	C_{RSS}	-	0.5	-	pF

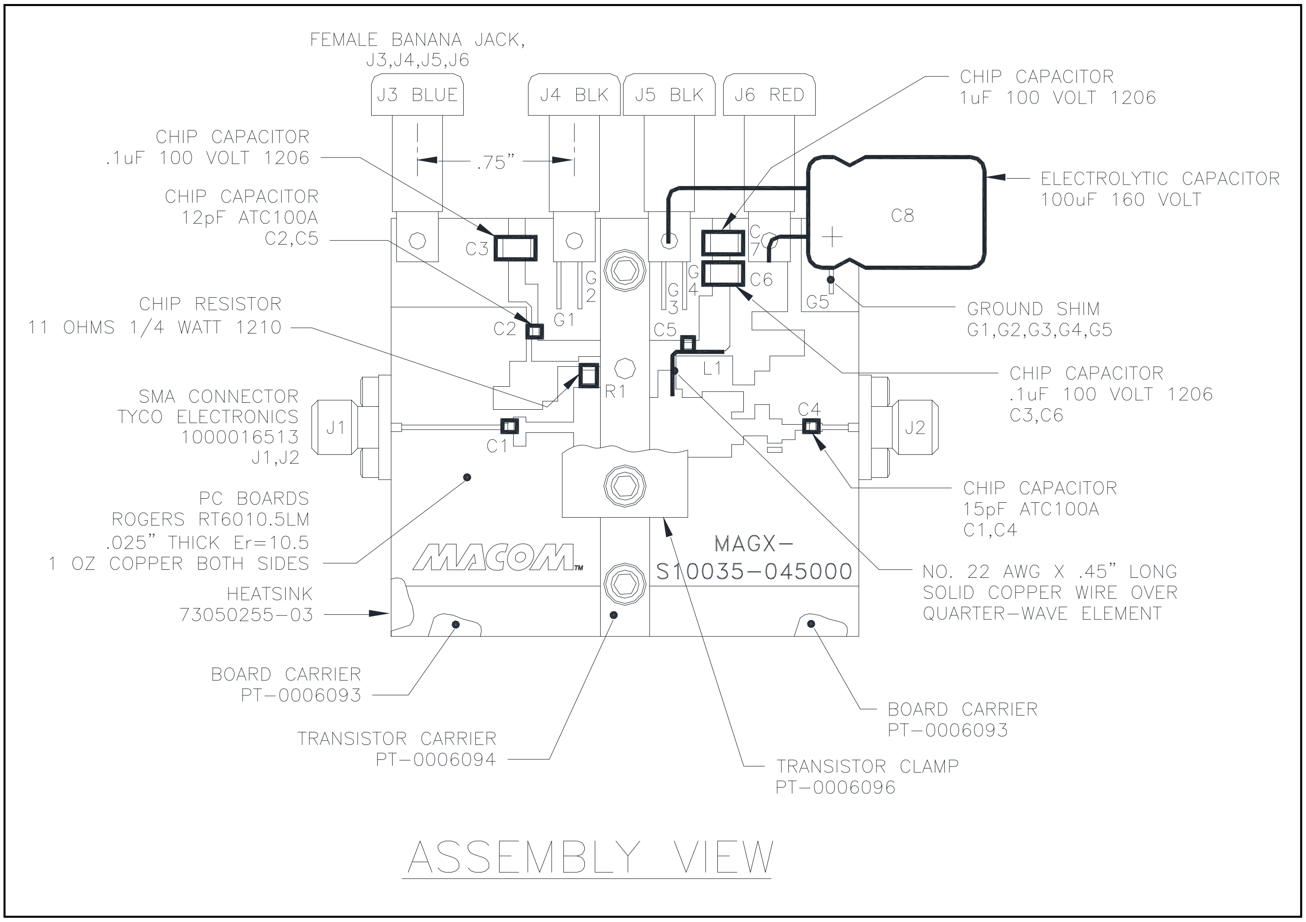
1. Electrical Specifications measured in MACOM RF evaluation board.

Absolute Maximum Ratings[2,3,4]

Parameter	Limit
Supply Voltage (V_{DD}) (Pulsed)	+65 V
Supply Voltage (V_{Gg})	-8 to 0 V
Supply Current (I_{DMAX}) for pulsed operation at V_{DD} = 50 V	3 A
Input Power (P_{IN}) for pulsed operation at V_{DD} = 50 V	P_{IN} (nominal) + 3 dB
Absolute Max. Junction/Channel Temperature	200ºC
Power Dissipation at 85 ºC for pulsed operation at V_{DD} = 50 V	48 W
MTTF (T_J<200°C)	600 years
Thermal Resistance, (T_J= 200 ºC) V_{DD} = 50 V, I_{DQ} = 100 mA, Pulsed 1 ms, 10% Duty Cycle	2.3 ºC/W
Operating Temperature	-40 to +95ºC
Storage Temperature	-65 to +150ºC
Mounting Temperature	See solder reflow profile
ESD Min. - Charged Device Model (CDM)	200 V
ESD Min. - Human Body Model (HBM)	550 V

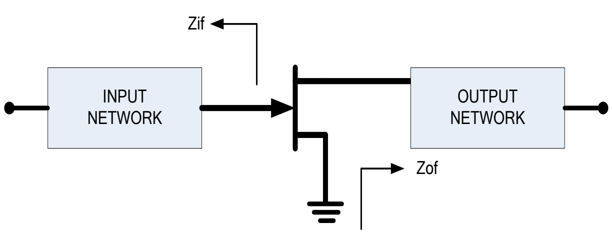
2. Operation of this device above any one of these parameters may cause permanent damage.
3. Channel temperature directly affects a device's MTTF. Channel temperature should be kept as low as possible to maximize lifetime.
4. For saturated performance it is recommended that the sum of ($3*V_{DD}$ + abs(V_{GG})) <175 V.

Test Fixture Assembly (2700-3500 MHz)



Test Fixture Impedances

F (MHz)	Z_{IF} (Ω)	Z_{OF} (Ω)
2700	7.7 - j3.9	7.5 + j3.0
2900	8.0 - j5.2	7.9 + j1.8
3100	7.2 - j6.8	7.5 + j8.3
3300	5.2 - j7.7	6.8 + j3.9
3500	3.1 - j7.1	6.0 + j7.1



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}.

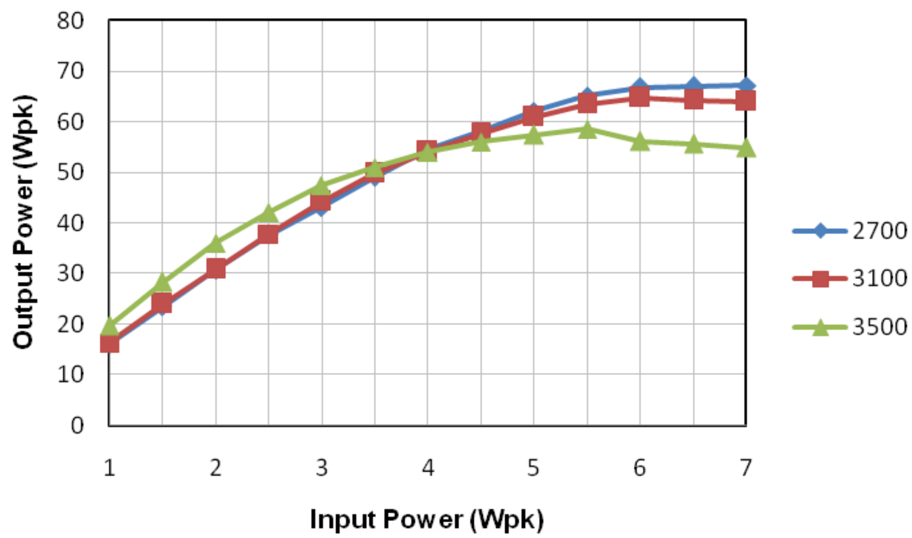
Contact factory for Gerber file or additional circuit information.

Application Section

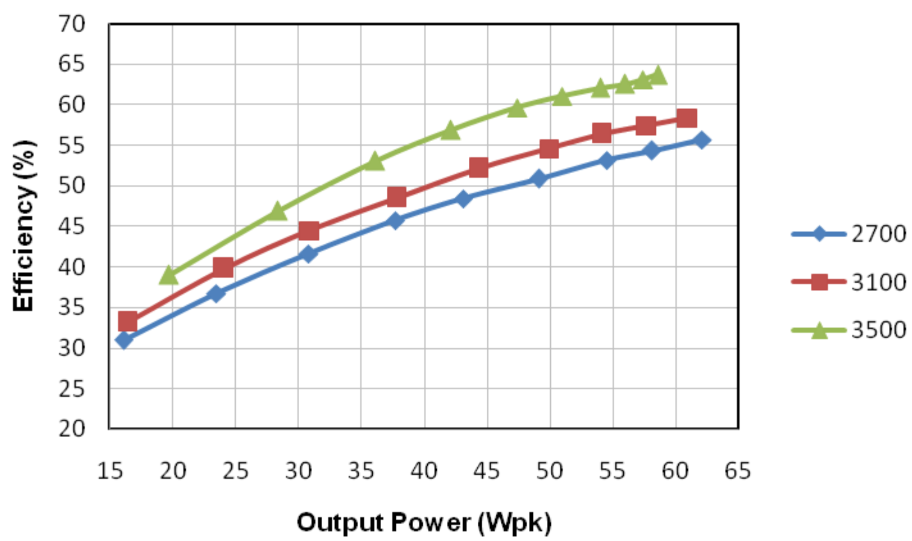
Typical Performance Curves

2700 - 3500 MHz, 1 ms Pulse, 10% Duty, V_{DD} = 50 V, Idq = 100 mA, T_A = 25°C

Output Power Vs. Input Power



Drain Efficiency Vs. Output Power

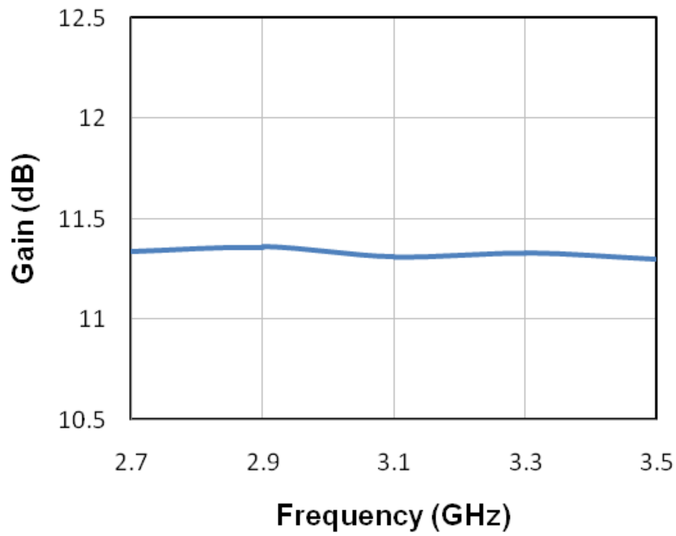


Application Section

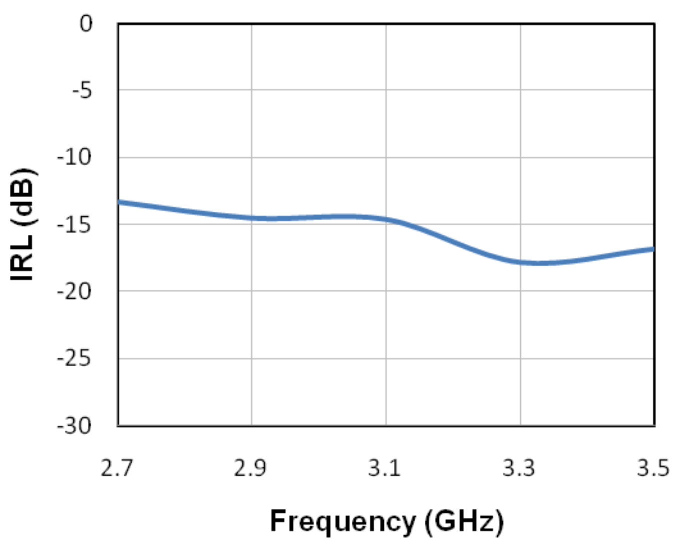
Typical Performance Curves

2700 - 3500 MHz, 1 ms Pulse, 10% Duty, V_{DD} = 50 V, Idq = 100 mA, T_A = 25°C

Gain vs. Frequency



Input Return Loss vs. Frequency

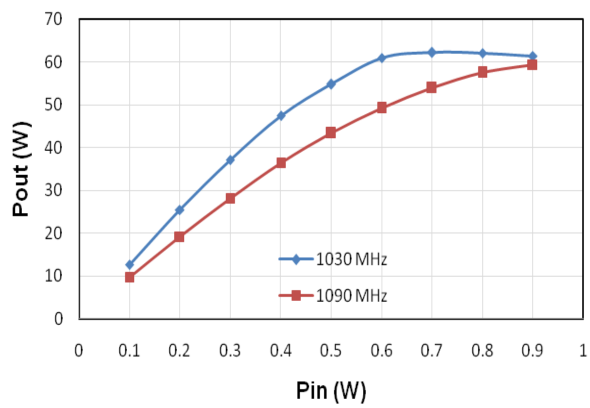


Application Section

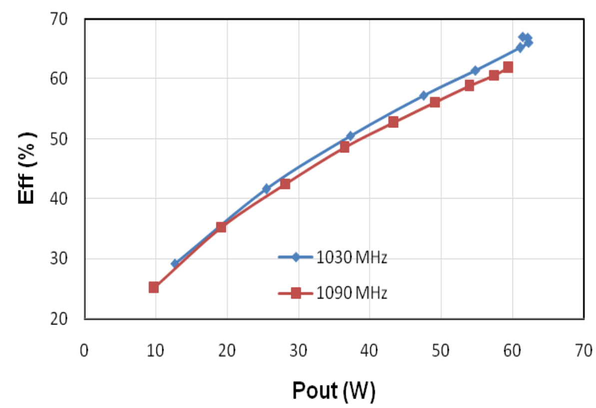
Typical Performance Curves

1030 - 1090 MHz, 1 ms Pulse, 10% Duty, V_{DD} = 50 V, Idq = 100 mA, T_A = 25°C

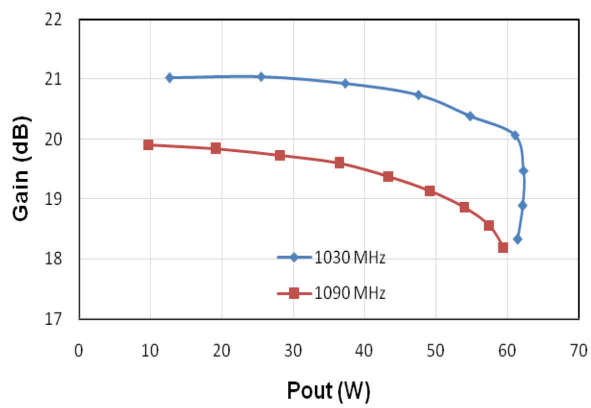
Output Power vs. Input Power



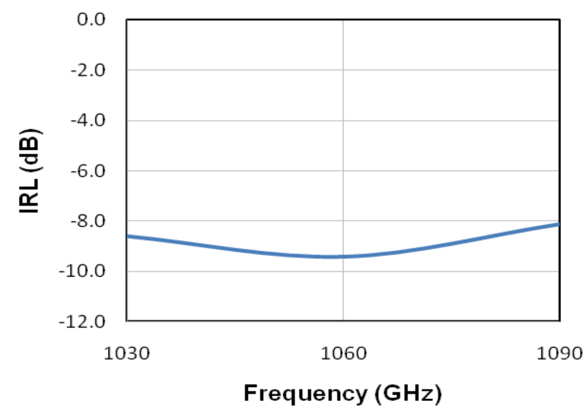
Drain Efficiency Vs. Output Power



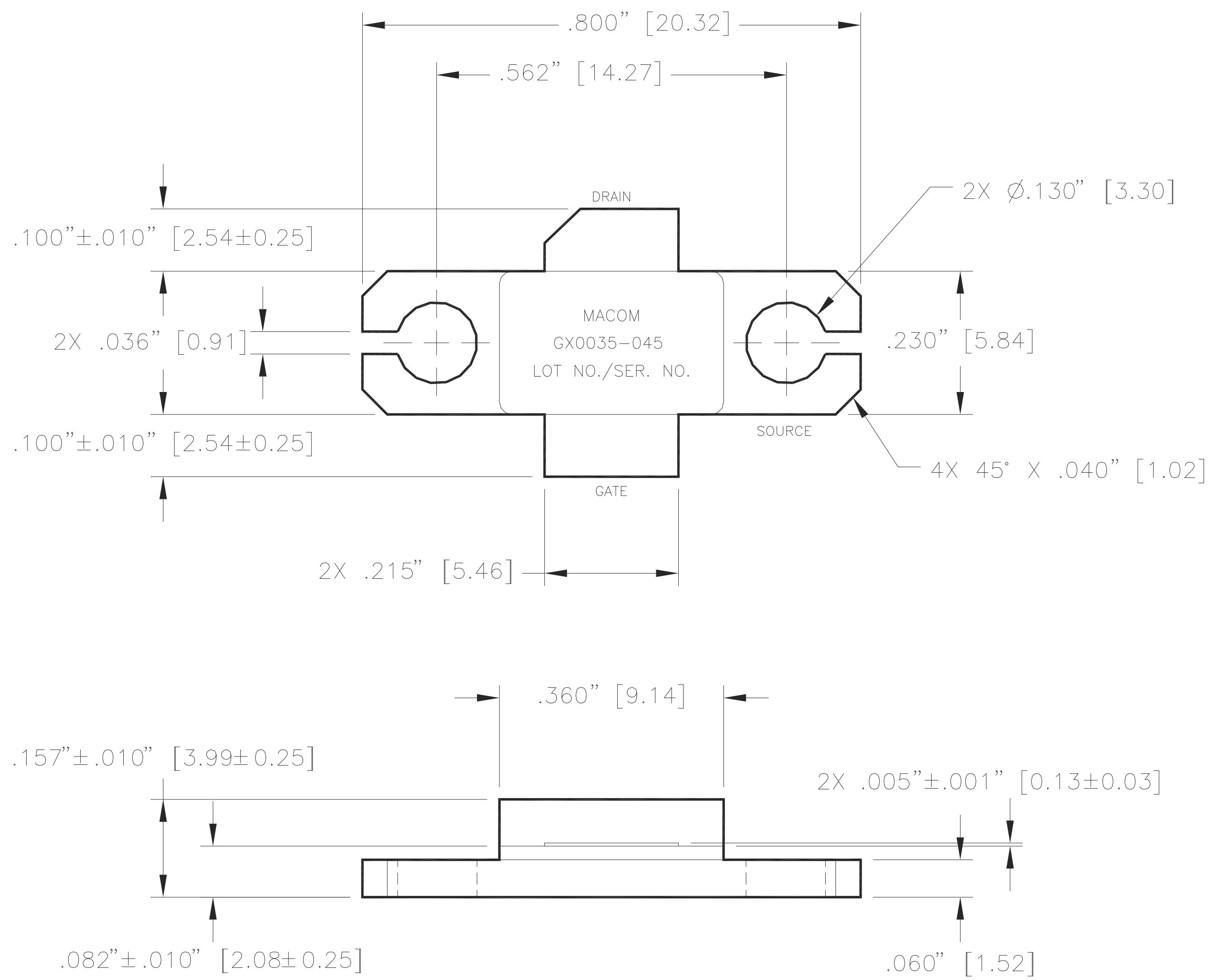
Gain vs. Output Power



Input Return Loss vs. Frequency



Outline Drawing MAGX-000035-045000



Unless otherwise noted, tolerances are inches ±.005" [millimeters ±0.13mm]