MAGX-001220-100L00

GaN on SiC HEMT Pulsed Power Transistor
100 W Peak, 1.2 to 2.0 GHz, 300 µs Pulse, 10% Duty

Rev. V2

Features

- GaN on SiC Depletion-Mode HEMT Transistor
- Common-Source Configuration
- Broadband Class AB Operation
- Thermally Enhanced Cu/Mo/Cu Package
- RoHS* Compliant
- +50 V Typical Operation
- MTTF = 600 Years (T_J < 200°C)
- EAR99 Export Classification
- MSL-1

Applications

- General Purpose for Pulsed or CW Applications
- Commercial Wireless Infrastructure (WCDMA, LTE, WIMAX)
- Civilian and Military Radar
- Military and Commercial Communications
- Public Radio
- Industrial, Scientific, and Medical
- SATCOM
- Instrumentation
- DTV

Description

The MAGX-001220-100L00 is a gold metalized Gallium Nitride (GaN) on Silicon Carbide 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 multiple octave bandwidths for today's demanding application needs. The MAGX-001220-100L00 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.

Ordering Information

Part Number	Description
MAGX-001220-100L00	100 W GaN Power Transistor
MAGX-001220-SB1PPR	1.2-2.0 GHz Evaluation Board

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* Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

Electrical Specifications: Freq. = 1.2 - 2.0 GHz, T_A = +25°C

Parameter	Symbol	Min.	Typ.	Max.	Units
RF Functional Tests: P_{IN} = 4 W, V_{DD} = 50 V, I_{DQ} = 500 mA, Pulse Width = 300 µs, Duty = 10%					
Peak Output Power	P_{OUT}	100	110	-	W
Power Gain	G_P	14.0	14.8	-	dB
Drain Efficiency	η_D	50	55	-	%
Load Mismatch Stability	VSWR-S	-	5:1	-	-
Load Mismatch Tolerance	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}	-	-	6	mA
Gate Threshold Voltage	V_{DS} = 5 V, I_D = 15 mA	$V_{GS\ (TH)}$	-5	-3	-2	V
Forward Transconductance	V_{DS} = 5 V, I_D = 3.5 A	G_M	2.5	-	-	S
Dynamic Characteristics						
Input Capacitance	Not Applicable (Input Matched)	C_{ISS}	N/A	N/A	N/A	pF
Output Capacitance	V_{DS} = 50 V, V_{GS} = -8 V, F = 1 MHz	C_{OSS}	-	30.3	35	pF
Reverse Transfer Capacitance	V_{DS} = 50 V, V_{GS} = -8 V, F = 1 MHz	C_{RSS}	-	2.8	5.4	pF

Absolute Maximum Ratings[1,2,3,4,5]

Parameter	Limit
Input Power (P_{IN})	P_{IN} (nominal) + 3 dB
Drain Supply Voltage (V_{DD})	+65 V
Gate Supply Voltage (V_{GG})	-8 to 0 V
Peak Supply Current (I_{DD})	9 A
Junction/Channel Temperature	+200ºC
Average Pulsed Power Dissipation at 85ºC	105 W
Operating Temperature	-40 to +95ºC
Storage Temperature	-65 to +150ºC
ESD Min. - Charged Device Model (CDM)	300 V
ESD Min. - Human Body Model (HBM)	600 V

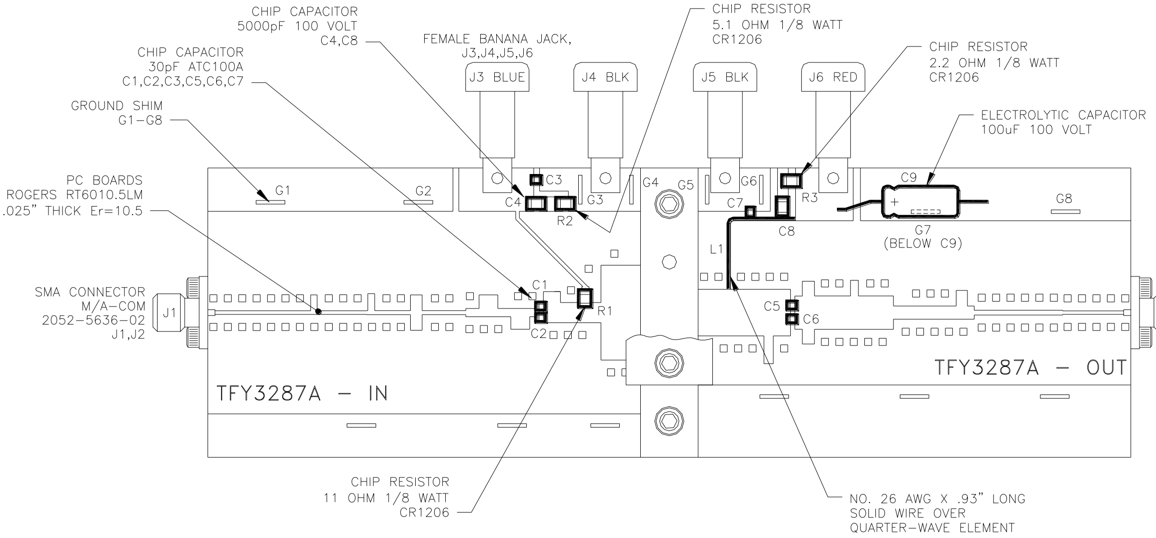
1. Exceeding any one or combination of these limits may cause permanent damage to this device.
2. MACOM does not recommend sustained operation near these survivability limits.
3. For saturated performance, the following is recommended: $(3 \cdot V_{DD} + \text{abs}(V_{GG})) < 175$ V.
4. Operating at nominal conditions with $T_J \leq +200°C$ will ensure MTTF > 1×10^6 hours. Junction temperature directly affects device MTTF and should be kept as low as possible to maximize lifetime.
5. Junction Temperature (T_J) = $T_C + \Theta_{JC} * ((V * I) - (P_{OUT} - P_{IN}))$.

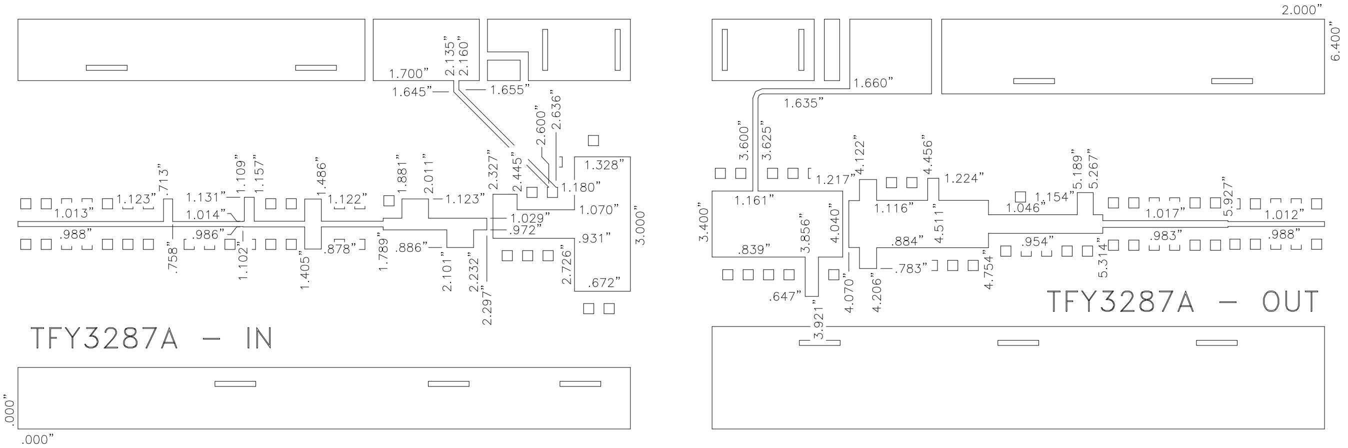
   Typical Transient Thermal Resistances (Freq. = 2.0 GHz, I_{DQ} = 500 mA):

   - Θ_{JC} = 0.68°C/W, Pulse Width = 300 µs, 10% duty cycle
     T_J = 135°C (T_C = 80°C, 50 V, 3.71 A, P_{OUT} = 108 W, P_{IN} = 4 W)

   - Θ_{JC} = 0.97°C/W, Pulse Width = 1000 µs, 10% duty cycle
     T_J = 160°C (T_C = 80°C, 50 V, 3.64 A, P_{OUT} = 103 W, P_{IN} = 4 W)

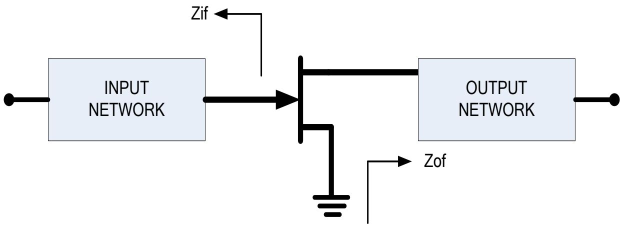
Evaluation Board Assembly & Circuit Dimensions (1.2 - 2.0 GHz)





Evaluation Board Impedances

Freq. (MHz)	Z_{IF} (Ω)	Z_{OF} (Ω)
1200	3.9 - j2.9	8.6 + j1.1
1400	4.2 - j1.8	6.9 + j0.2
1600	4.7 - j2.2	6.8 + j0.7
1800	3.5 - j2.8	6.1 - j0.6
2000	2.2 - j1.9	3.2 + j0.4



Correct Device Sequencing

Turning the device ON

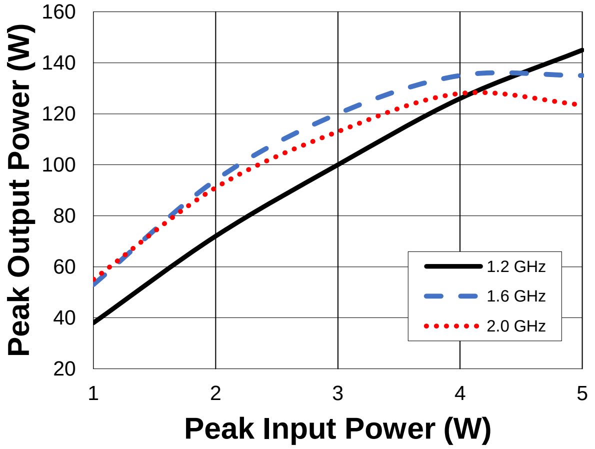
1. Set V_{GS} to the pinch-off (V_P), typically -5 V.
2. Turn on V_{DS} to nominal voltage (50 V).
3. Increase V_{GS} until the I_{DS} current is reached.
4. Apply RF power to desired level.

Turning the device OFF

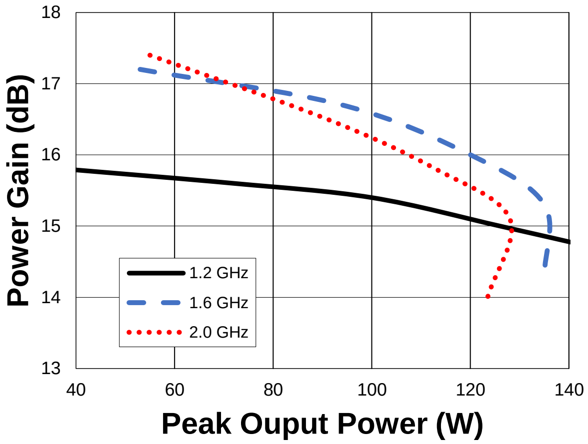
1. Turn the RF power off.
2. Decrease V_{GS} down to $V_{P.}$
3. Decrease V_{DS} down to 0 V.
4. Turn off $V_{GS.}$

Typical Performance Curves

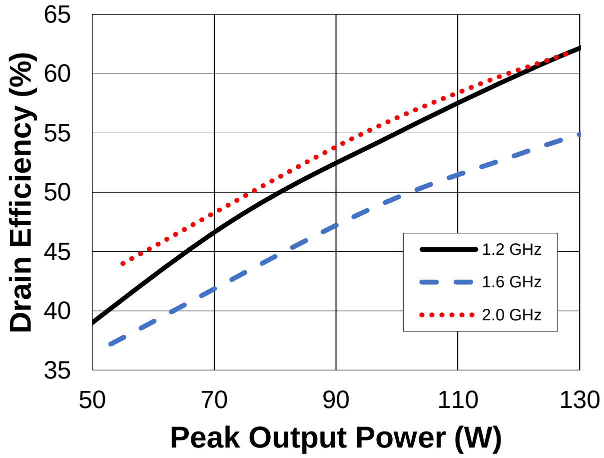
Peak Output Power vs. Peak Input Power



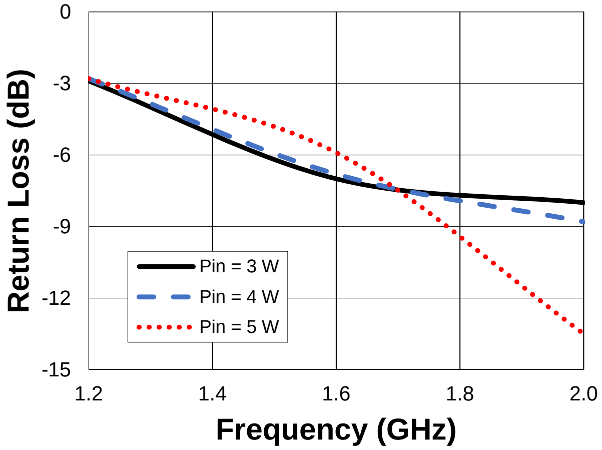
Power Gain vs. Peak Output Power



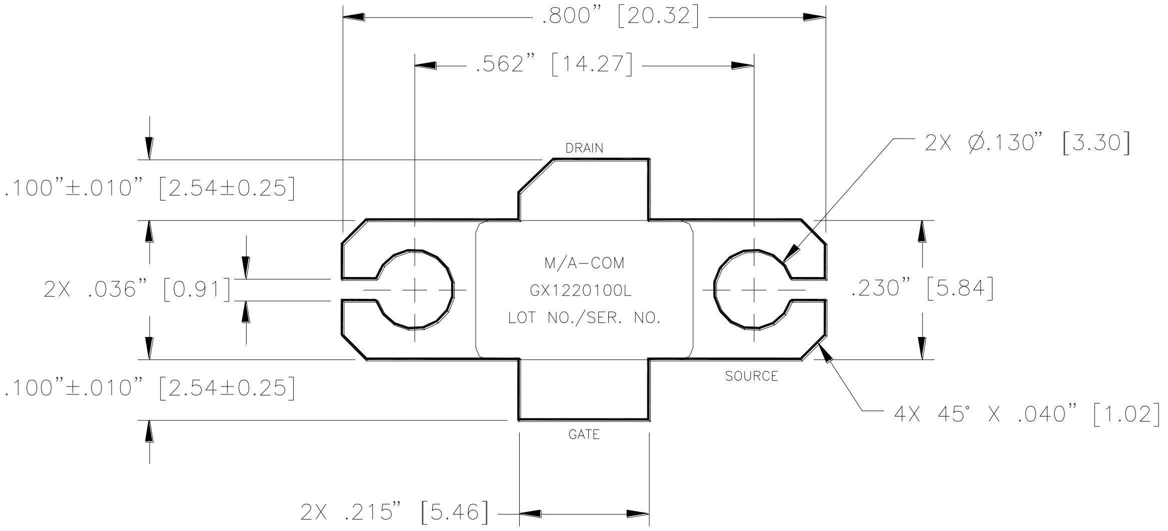
Drain Efficiency vs. Peak Output Power

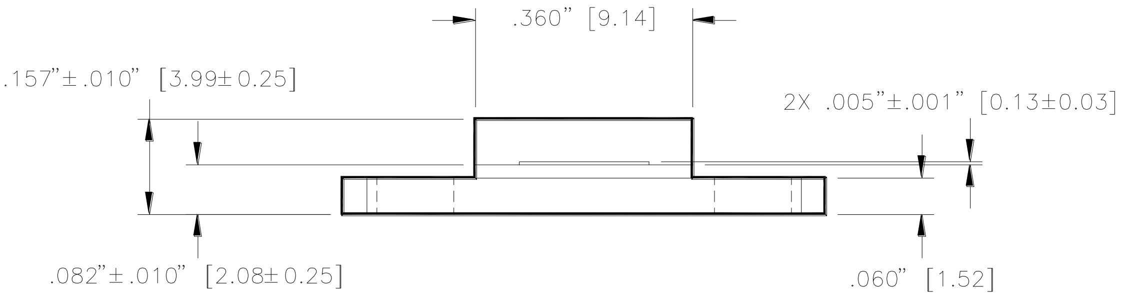


Return Loss vs. Frequency



Package Outline





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

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

Gallium Nitride devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.