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

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 todav'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.

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Ordering Information

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

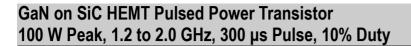
* Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

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

Parameter	Symbol	Min.	Тур.	Max.	Units
RF Functional Tests: $P_{IN} = 4 \text{ W}$, $V_{DD} = 50 \text{ V}$, $I_{DQ} = 500 \text{ mA}$, 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.	Тур.	Max.	Units
DC Characteristics						
Drain-Source Leakage Current	$V_{GS} = -8 V, V_{DS} = 175 V$	I _{DS}	-	-	6	mA
Gate Threshold Voltage	$V_{\text{DS}} = 5 \text{ V}, \text{ I}_{\text{D}} = 15 \text{ mA}$	V _{GS (TH)}	-5	-3	-2	V
Forward Transconductance	$V_{DS} = 5 \text{ V}, \text{ I}_{D} = 3.5 \text{ A}$	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	$V_{DS} = 50 \text{ V}, V_{GS} = -8 \text{ V}, F = 1 \text{ MHz}$	C _{RSS}	-	2.8	5.4	pF

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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	+200°C
Average Pulsed Power Dissipation at 85°C	105 W
Operating Temperature	-40 to +95°C
Storage Temperature	-65 to +150°C
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: $(3^*V_{DD} + abs(V_{GG})) < 175 \text{ V}$. Operating at nominal conditions with $T_J \le +200^\circ\text{C}$ will ensure MTTF > 1 x 10⁶ hours. Junction temperature directly affects device MTTF 4 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 (Freg. = 2.0 GHz, I_{DQ} = 500 mA):

- $\Theta_{\rm IC} = 0.68^{\circ}$ 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)
- $\Theta_{JC} = 0.97^{\circ}C/W$, Pulse Width = 1000 µs, 10% duty cycle . $T_J = 160^{\circ}C (T_C = 80^{\circ}C, 50 \text{ V}, 3.64 \text{ A}, P_{OUT} = 103 \text{ W}, P_{IN} = 4 \text{ W})$



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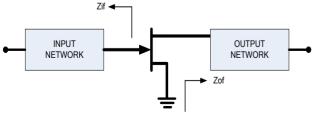
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CHIP CAPACITOR 5000pF 100 VOLT C4,C8 CHIP RESISTOR 5.1 OHM 1/8 WATT CR1206 FEMALE BANANA JACK, J3,J4,J5,J6 CHIP RESISTOR CHIP CAPACITOR 2.2 OHM 1/8 WATT CR1206 30pF ATC100A C1,C2,C3,C5,C6,C7 J3 BLUE J4 BLK J5 BLK J6 RED GROUND SHIM ELECTROLYTIC CAPACITOR 100uF 100 VOLT G1-G8 PC BOARDS ROGERS RT6010.5LM .025" THICK Er=10.5 ð **C**3 0 0 G6 Ċ 0 G5 G1 G2 63 Õ P3 68 Π С CE G7 (BELOW C9) п 0 п _ _ _ _ SMA CONNECTOR M/A-COM 2052-5636-02 J1,J2 ⅊₿₰ d C5 8 C6 Ľ. J2 _<u>____</u>_____ Uooooo 000 \bigcirc TFY3287A - OUT TFY3287A - IN _ O ____ CHIP RESISTOR NO. 26 AWG X .93" LONG SOLID WIRE OVER QUARTER-WAVE ELEMENT 11 OHM 1/8 WATT CR1206 2 000* 6.400" 35**°** 22 1.700 660 _ 655 1.645 2.636" 1.635 -2.600" 600 525 22" 456" 2.011" 45, 1.328 109 486" 881 1.224 □ 1,154" <u>1.04</u>6" 180' 1.131"-1.161" □ □ _{1.013}" □^{1.123}" 1<u>.122</u>" D 1.123 ا 🖧 🗆 🛄 🛄 🗠 🔤 1 116 1.070¹ 4.040" 1.014"-400 0000' .986 L 856 4.51 .931" , 1 0 0 [|] °. – °L 🗆 🗆 🗠 878"] 8.886 .884" Π пП П 726 .839* 2.232"L 2.297"--.783"] 🗆 🗆 🕺 405' 2.101 4.070 .672 L.206" .647" . 921" L TFY3287A - OUT TFY3287A - IN -^m-____ _ _

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

Evaluation Board Impedances

Z _{IF} (Ω)	Z _{OF} (Ω)
3.9 - j2.9	8.6 + j1.1
4.2 - j1.8	6.9 + j0.2
4.7 - j2.2	6.8 + j0.7
3.5 - j2.8	6.1 - j0.6
2.2 - j1.9	3.2 + j0.4
	3.9 - j2.9 4.2 - j1.8 4.7 - j2.2 3.5 - j2.8



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 $V_{GS.}$

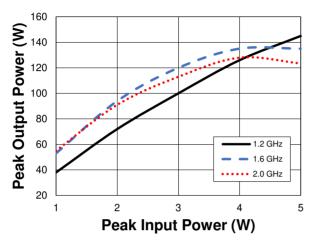
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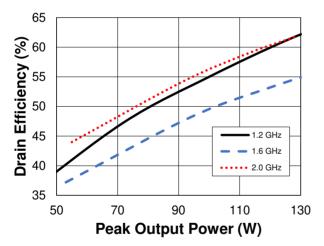
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Typical Performance Curves

Peak Output Power vs. Peak Input Power



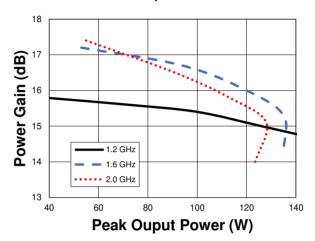
Drain Efficiency vs. Peak Output Power



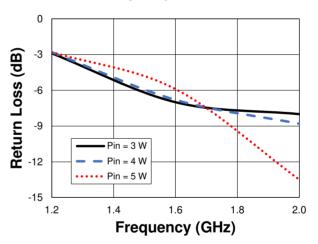
Power Gain vs. Peak Output Power



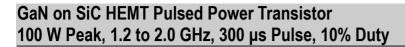
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Return Loss vs. Frequency



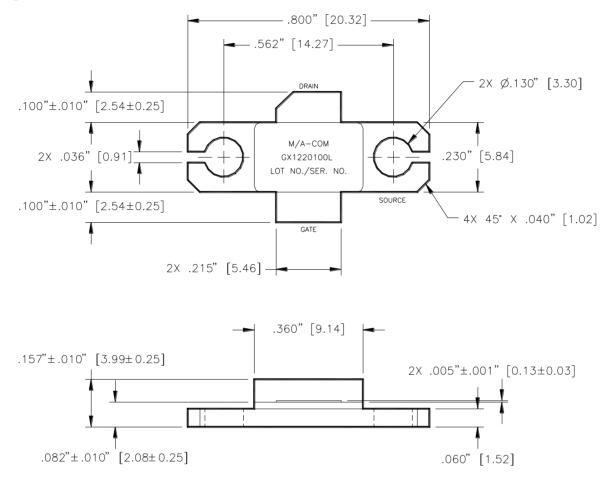
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Package Outline



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

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.

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