



## GaN on SiC HEMT Pulsed Power Transistor 125W Peak, 1200-1400 MHz, 300µs Pulse, 10% Duty

Production V1  
18 Aug 11

### Features

- GaN depletion mode HEMT microwave transistor
- Internally matched
- Common source configuration
- Broadband Class AB operation
- RoHS Compliant
- +50V Typical Operation
- MTTF of 114 years (Channel Temperature < 200°C)

### Applications

- L-Band Pulsed Radar

### Product Description

The MAGX-001214-125L00 is a gold metalized matched Gallium Nitride (GaN) on Silicon Carbide RF power transistor optimized for pulsed L-Band radar applications. Using state of the art wafer fabrication processes, these high performance transistors provide high gain, efficiency, bandwidth, ruggedness over a wide bandwidth for today's demanding application needs. High breakdown voltages allow for reliable and stable operation in extreme mismatched load conditions unparalleled with older semiconductor technologies.



### Typical RF Performance at Pout = 125W Peak

Freq (MHz)	Pin (W)	Gain (dB)	Slope (dB)	Id (A)	Eff (%)	Avg-Eff (%)	RL (dB)	Droop (dB)
1200	1.8	18.3	-	4.0	43.0	-	-9.0	0.4
1250	1.9	18.1	-	4.2	59.0	-	-11.6	0.6
1300	2.0	18.0	-	4.4	56.5	-	-16.0	0.6
1350	1.9	18.1	-	4.3	57.7	-	-19.0	0.5
1400	1.8	18.4	0.4	3.9	62.9	59.8	-14.5	0.3

Typical RF performance measured in M/A-COM RF test fixture. Devices tested in common source Class-AB configuration as follows:  
Vdd=50V, Idq=100mA (pulsed), F=1200-1400 MHz, Pulse=300us, Duty=10%.

### Ordering Information

MAGX-001214-125L00 125W GaN Power Transistor  
MAGX-001214-SB0PPR Evaluation Fixture

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**Absolute Maximum Ratings Table (1, 2, 3)**

Supply Voltage ( $V_{DD}$ )	+65V
Supply Voltage ( $V_{GS}$ )	-8 to -2V
Supply Current ( $I_{D_{MAX}}$ )	4.8 Apk
Input Power ( $P_{IN}$ )	+37 dBm
Absolute Max. Junction/Channel Temp	200°C
MTTF ( $T_J < 200^\circ\text{C}$ )	114 years
Pulsed Power Dissipation at 85°C	115 Wpk
Thermal Resistance, ( $T_J = 70^\circ\text{C}$ ) $V_{DD} = 50\text{V}$ , $I_{DQ} = 100\text{mA}$ , $P_{out} = 125\text{W}$ 300µs Pulse / 10% Duty	1.0°C/W
Operating Temp	-40 to +95°C
Storage Temp	-65 to +150°C
Mounting Temperature	See solder reflow profile
ESD Min. - Machine Model (MM)	50V
ESD Min. - Human Body Model (HBM)	>250V
MSL Level	MSL1

(1) Operation of this device above any one of these parameters may cause permanent damage.

(2) Channel temperature directly affects a device's MTTF. Channel temperature should be kept as low as possible to maximize lifetime.

(3) For saturated performance it recommended that the sum of ( $3 \cdot V_{dd} + \text{abs}(V_{gg})$ ) < 175

Parameter	Test Conditions	Symbol	Min	Typ	Max	Units
<b>DC CHARACTERISTICS</b>						
Drain-Source Leakage Current	$V_{GS} = -8\text{V}$ , $V_{DS} = 175\text{V}$	$I_{DS}$	-	0.2	6	mA
Gate Threshold Voltage	$V_{DS} = 5\text{V}$ , $I_D = 15.0\text{mA}$	$V_{GS(th)}$	-5	-3.8	-2	V
Forward Transconductance	$V_{DS} = 5\text{V}$ , $I_D = 3.5\text{mA}$	$G_M$	2.5	3.6	-	S
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	Not applicable—Input internally matched	$C_{iss}$	N/A	N/A	N/A	pF
Output Capacitance	$V_{DS} = 50\text{V}$ , $V_{GS} = -8\text{V}$ , $F = 1\text{MHz}$	$C_{oss}$	-	11	-	pF
Feedback Capacitance	$V_{DS} = 50\text{V}$ , $V_{GS} = -8\text{V}$ , $F = 1\text{MHz}$	$C_{rss}$	-	1.1	-	pF

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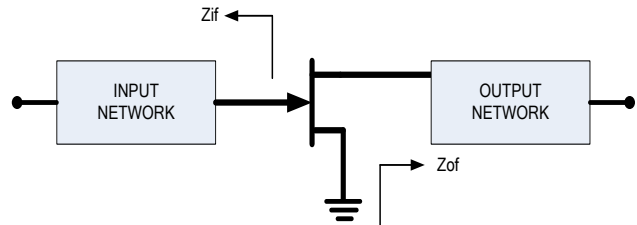
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**Electrical Specifications:  $T_C = 25 \pm 5^\circ\text{C}$  (Room Ambient )**

Parameter	Test Conditions	Symbol	Min	Typ	Max	Units
<b>RF FUNCTIONAL TESTS (<math>V_{DD} = 50\text{V}</math>, <math>I_{DQ} = 100\text{mA}</math>, <math>300\mu\text{s}</math> / 10% duty, 1200-1400MHz)</b>						
Input Power	$P_{out} = 125\text{Wpk}$ (12.5W avg)	$P_{IN}$	-	1.9	2.4	Wpk
Power Gain	$P_{out} = 125\text{Wpk}$ (12.5W avg)	$G_P$	17.2	18.1	-	dB
Drain Efficiency	$P_{out} = 125\text{Wpk}$ (12.5W avg)	$\eta_D$	54	59.8	-	%
Load Mismatch Stability	$P_{out} = 125\text{Wpk}$ (12.5W avg)	VSWR-S	5:1	-	-	-
Load Mismatch Tolerance	$P_{out} = 125\text{Wpk}$ (12.5W avg)	VSWR-T	10:1	-	-	-

### Test Fixture Impedance

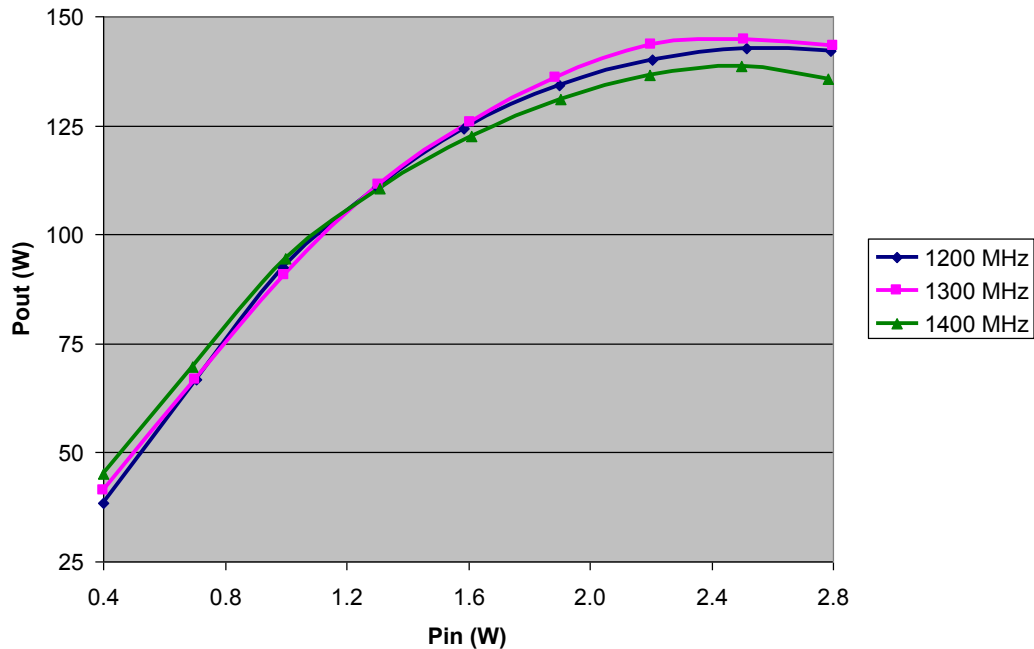
F (MHz)	$Z_{IF}$ ( $\Omega$ )	$Z_{OF}$ ( $\Omega$ )
1200	$6.6 - j7.1$	$8.0 + j1.9$
1250	$6.6 - j6.9$	$7.4 + j1.3$
1300	$6.6 - j6.7$	$6.6 + j1.3$
1350	$6.7 - j6.7$	$6.1 + j1.6$
1400	$6.7 - j6.7$	$5.7 + j2.2$



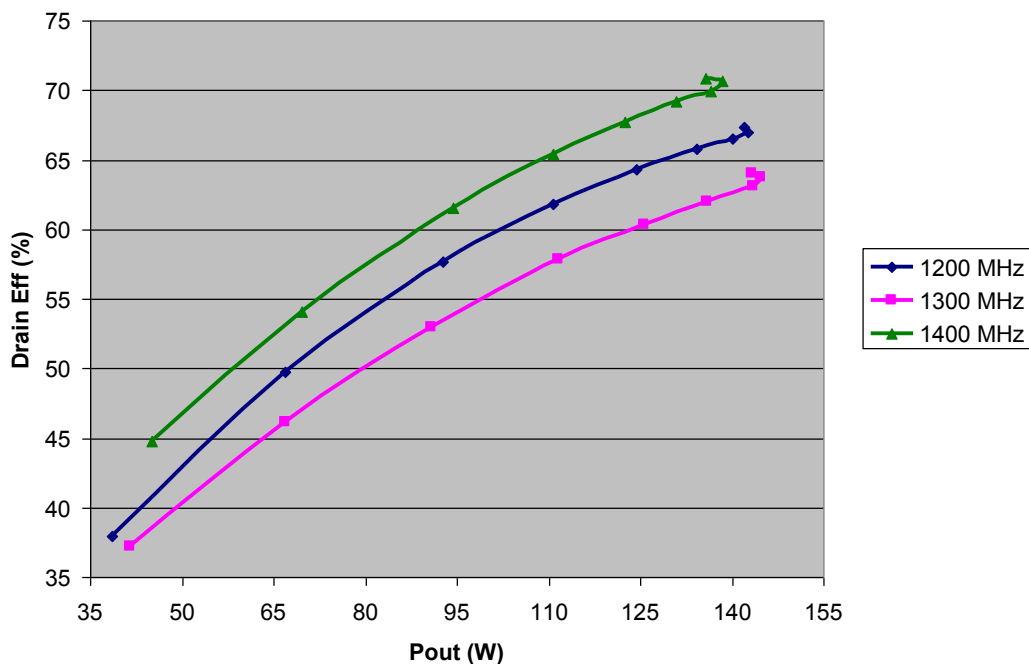
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### RF Power Transfer Curve (Output Power Vs. Input Power)



### RF Power Transfer Curve (Drain Efficiency Vs. Output Power)



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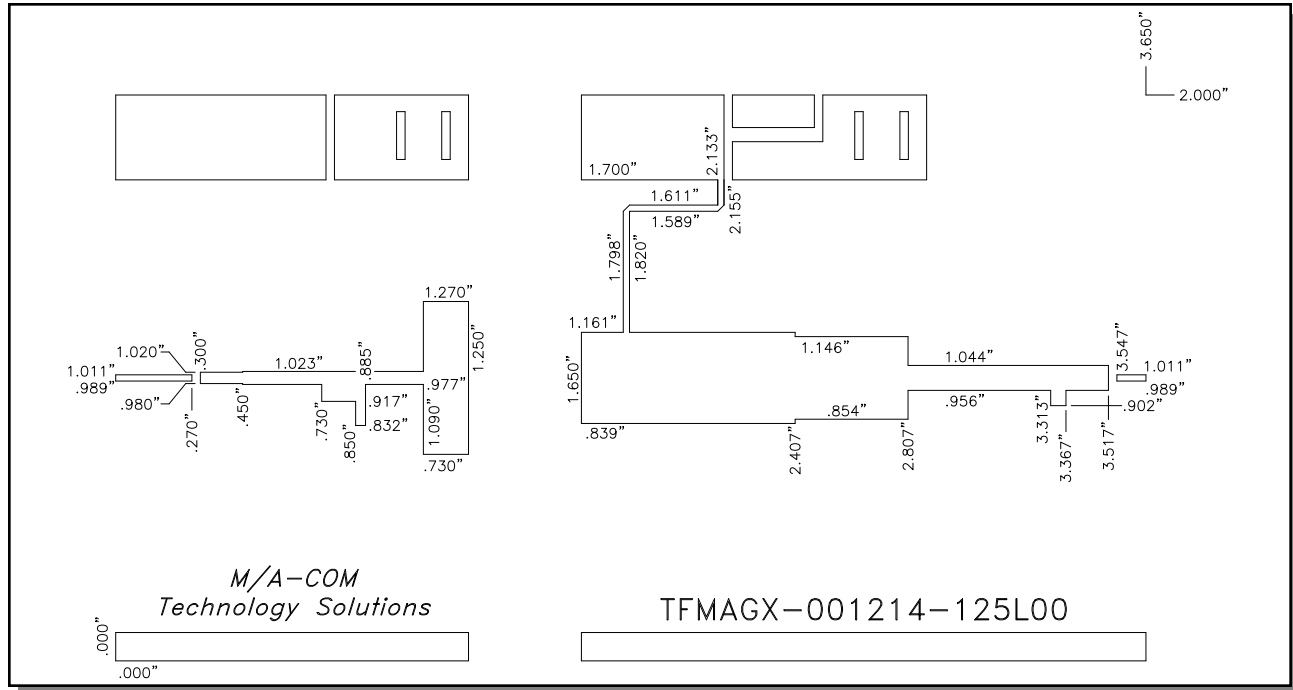
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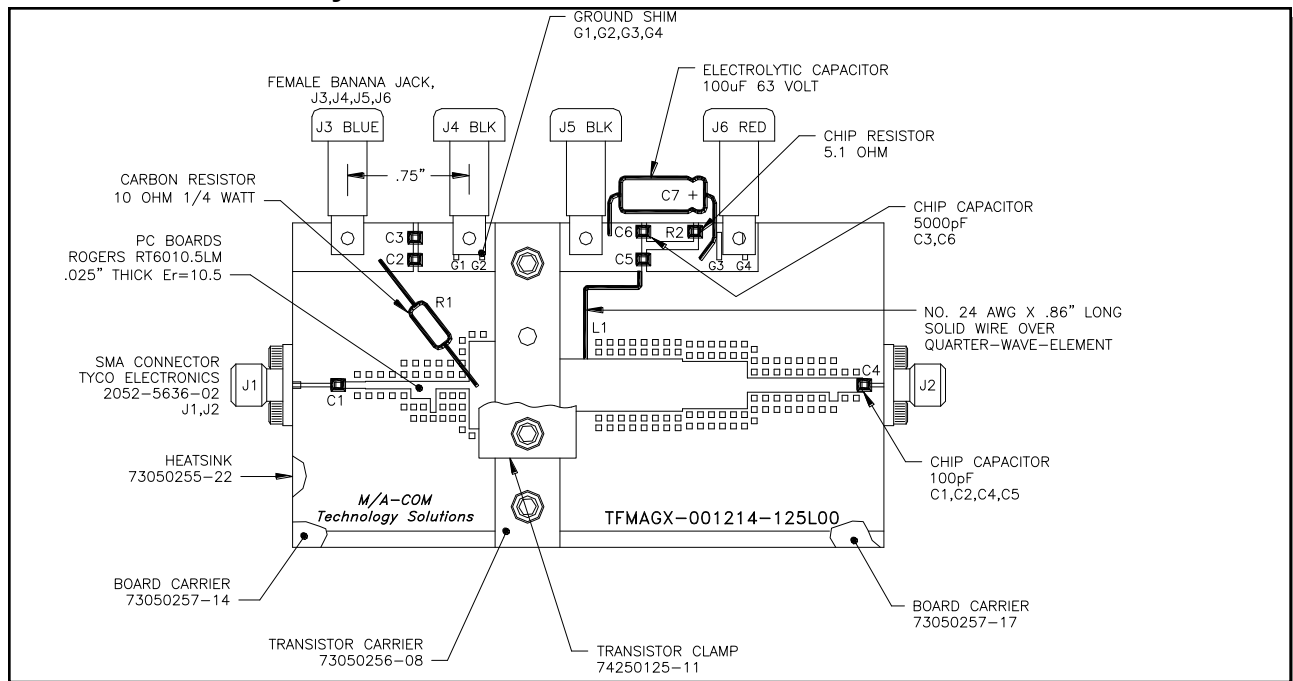
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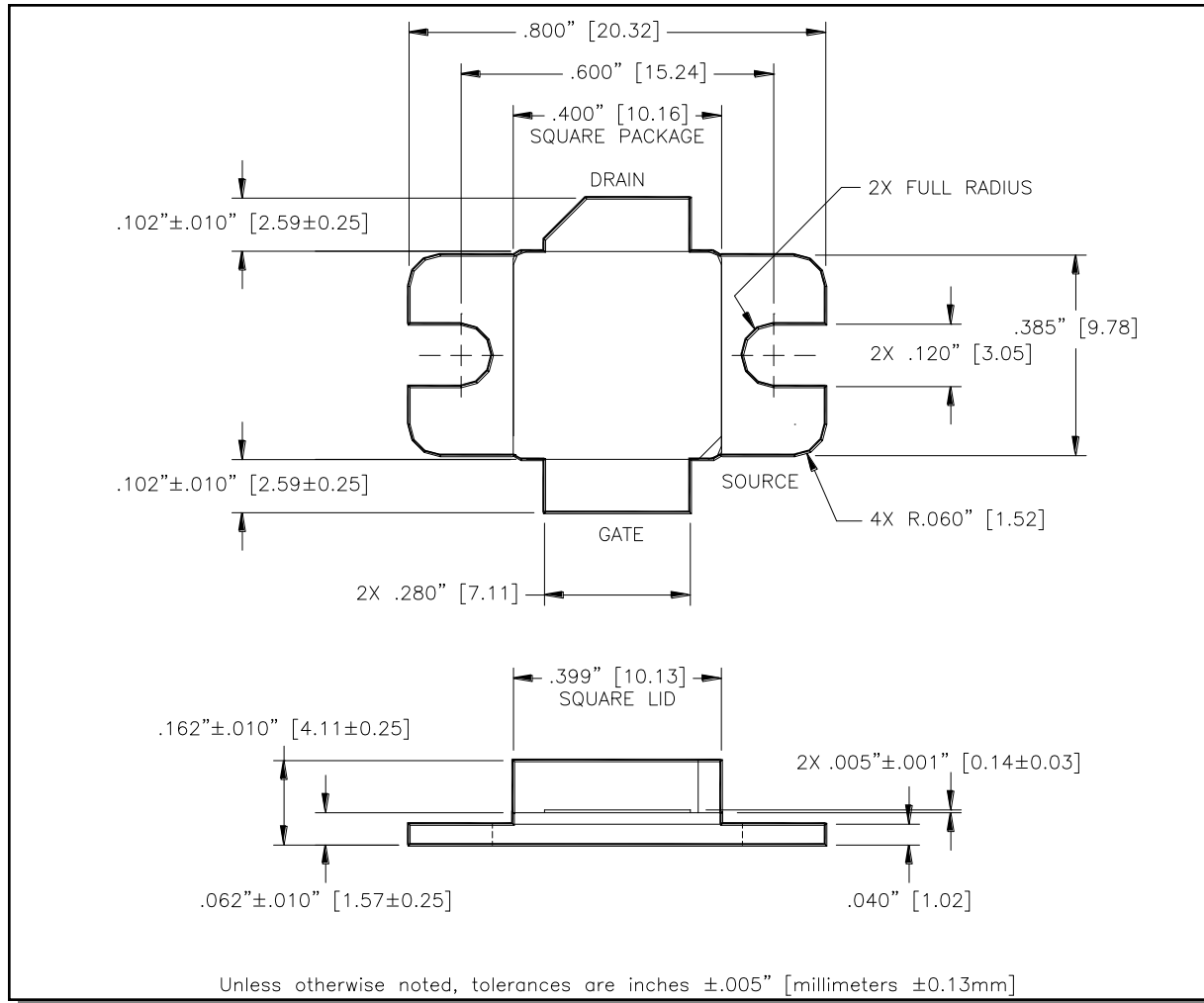
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## Test Fixture Circuit Dimensions



## Test Fixture Assembly



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**Outline Drawing**

**CORRECT DEVICE SEQUENCING**
**TURNING THE DEVICE ON**

1. Set  $V_{GS}$  to the pinch-off ( $V_P$ ), typically -5V
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 0V
4. Turn off  $V_{GS}$

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