



**GaN on SiC HEMT Pulsed Power Transistor**  
**125W Peak, 960-1215 MHz, 128µs 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**

- Avionics: Mode-S, TCAS, JTIDS, DME and TACAN.

**Product Description**

The MAGX-000912-125L00 is a gold metalized matched Gallium Nitride (GaN) on Silicon Carbide RF power transistor optimized for civilian and military pulsed avionics amplifier applications the 960 MHz to 1215 MHz range such as Mode-S, TCAS, JTIDS, DME and TACAN . 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)
960	1.4	19.7	-	3.9	64.4	-	-6.1	0.3
1030	1.3	19.8	-	4.0	61.6	-	-11.9	0.3
1090	1.6	18.9	-	4.1	60.4	-	-9.6	0.3
1150	1.7	18.6	-	4.1	61.4	-	-9.3	0.3
1215	1.6	18.9	1.2	4.0	61.9	61.9	-12.0	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=960-1215 MHz, Pulse=128us, Duty=10%.*

**Ordering Information**

MAGX-000912-125L00 125W GaN Power Transistor  
 MAGX-000912-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 ( $I_{D\ MAX}$ )	7.1 Apk
Input Power ( $P_{IN}$ )	+37dBm
Absolute Max. Junction/Channel Temp	200°C
MTTF ( $T_J < 200^\circ\text{C}$ )	114 years
Pulsed Power Dissipation at 85°C	230 Wpk
Thermal Resistance, ( $T_J = 70^\circ\text{C}$ ) $V_{DD} = 50\text{V}$ , $I_{DQ} = 100\text{mA}$ , $P_{out} = 125\text{W}$ 128 $\mu$ s Pulse / 10% Duty	0.5°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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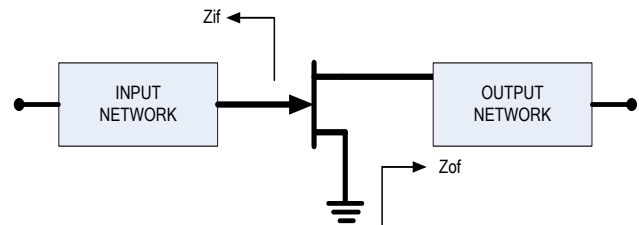
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**Electrical Specifications:  $T_C = 25 \pm 5^\circ\text{C}$  (Room Ambient )**

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>128\mu\text{s}</math> / 10% duty, 960-1215MHz)</b>						
Input Power	$P_{out} = 125\text{W Peak}$ (12.5W avg)	$P_{IN}$	-	1.6	2.2	Wpk
Power Gain	$P_{out} = 125\text{W Peak}$ (12.5W avg)	$G_P$	17.5	19.2	-	dB
Drain Efficiency	$P_{out} = 125\text{W Peak}$ (12.5W avg)	$\eta_D$	57	62	-	%
Load Mismatch Stability	$P_{out} = 125\text{W Peak}$ (12.5W avg)	VSWR-S	5:1	-	-	-
Load Mismatch Tolerance	$P_{out} = 125\text{W Peak}$ (12.5W avg)	VSWR-T	10:1	-	-	-

### Test Fixture Impedance

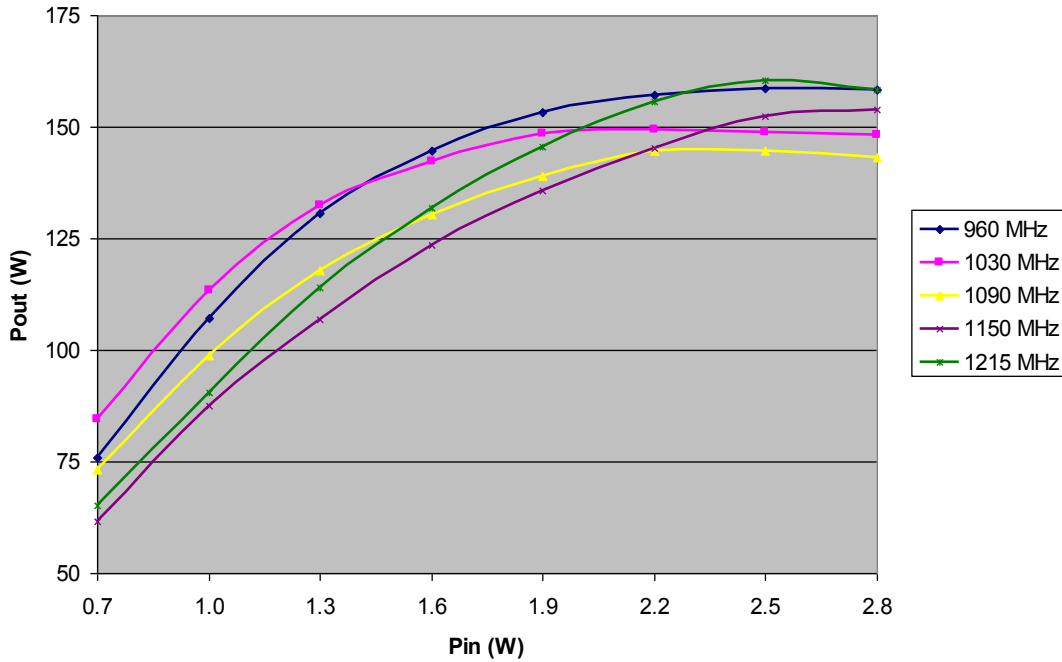
F (MHz)	$Z_{IF}$ ( $\Omega$ )	$Z_{OF}$ ( $\Omega$ )
960	$3.9 - j7.5$	$7.6 + j2.6$
1030	$3.7 - j6.6$	$8.3 + j1.5$
1090	$3.6 - j5.6$	$8.2 + j0.8$
1150	$4.7 - j6.0$	$8.0 + j0.6$
1215	$4.1 - j5.5$	$8.2 + j0.9$



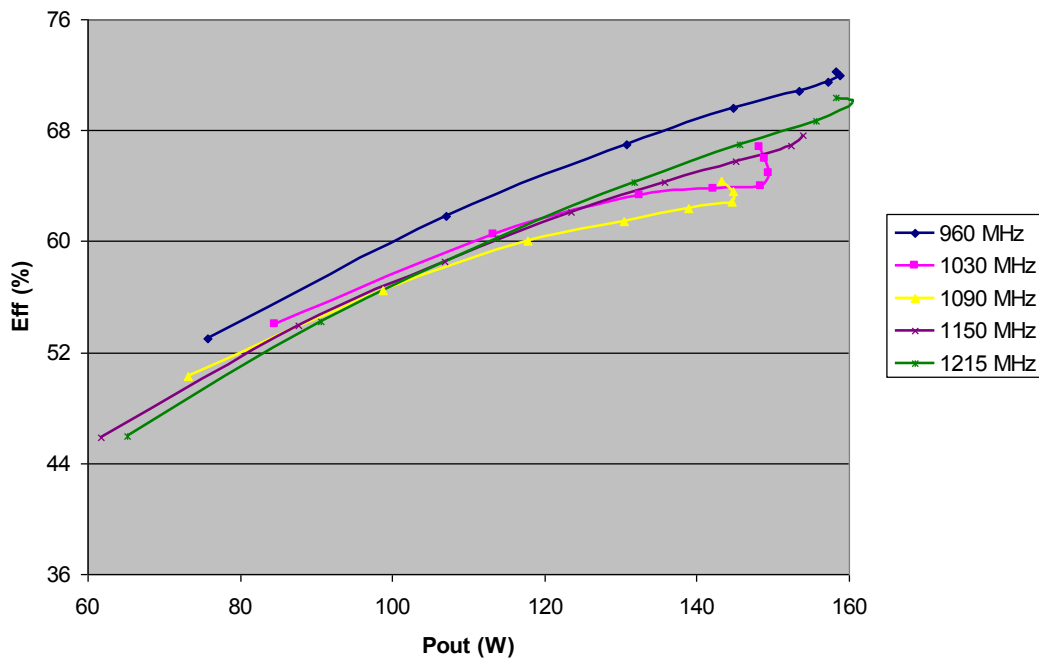
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RF Power Transfer Curve (Output Power Vs. Input Power)



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



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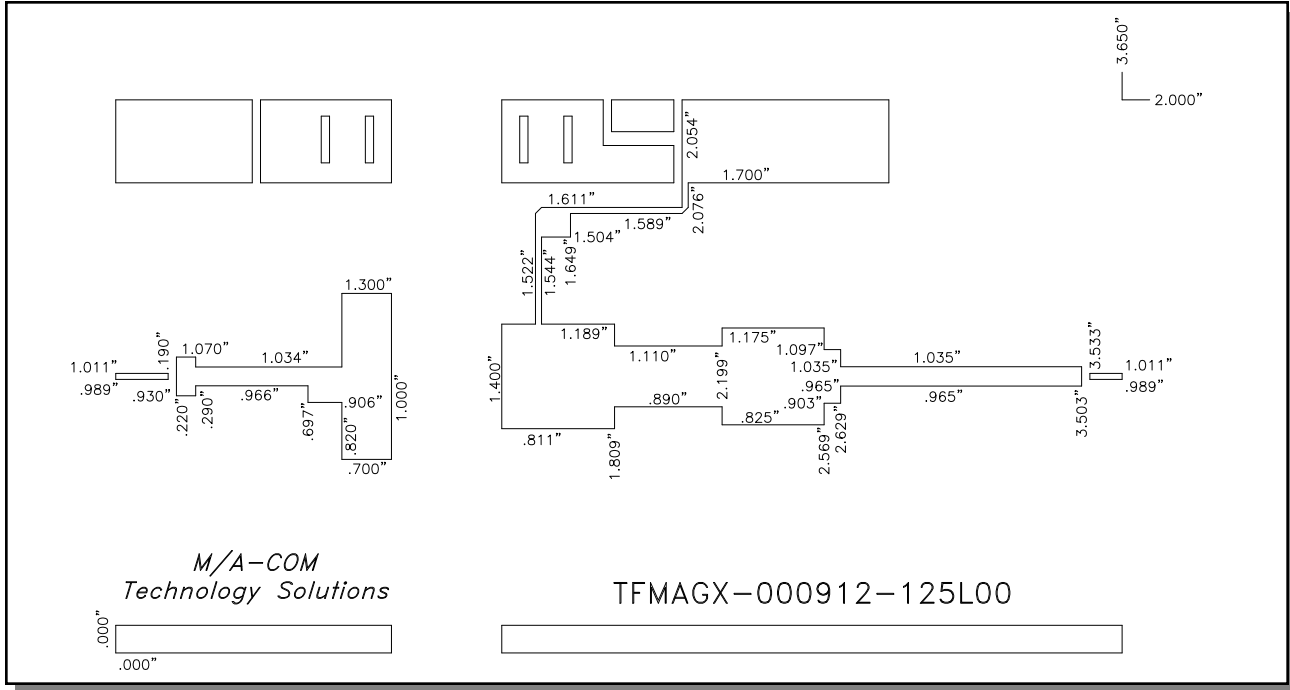
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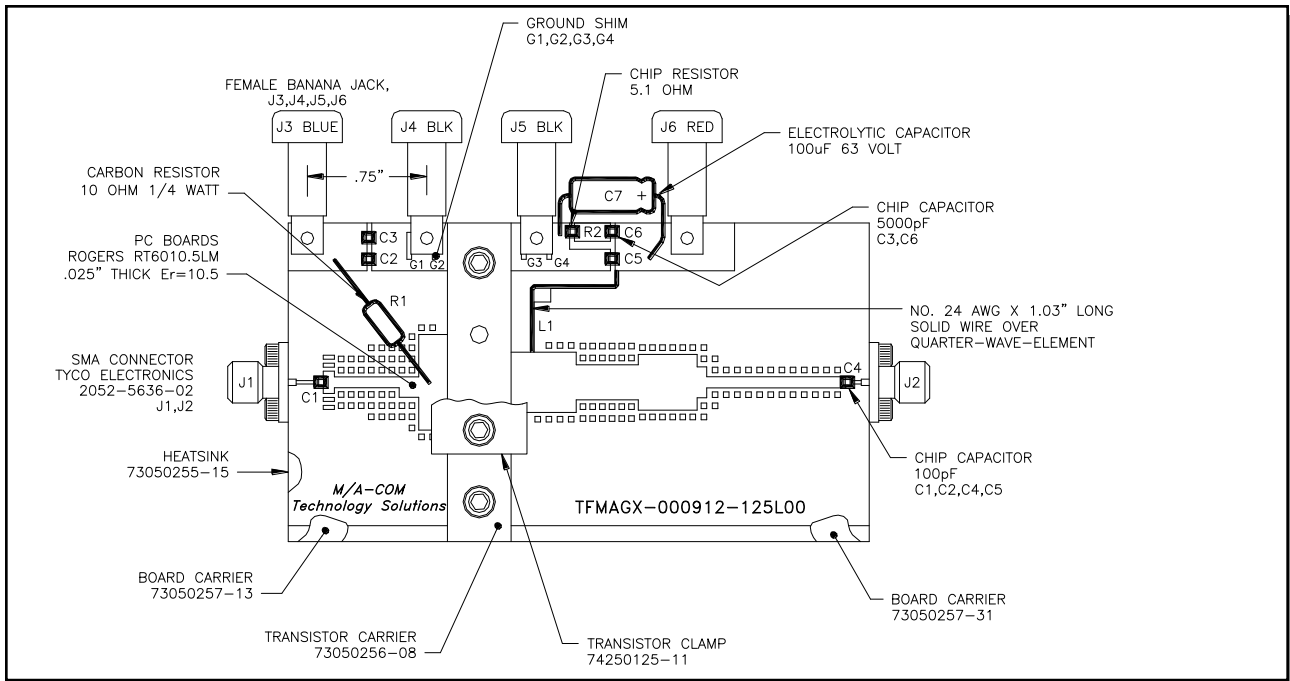
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## Test Fixture Circuit Dimensions



## Test Fixture Assembly



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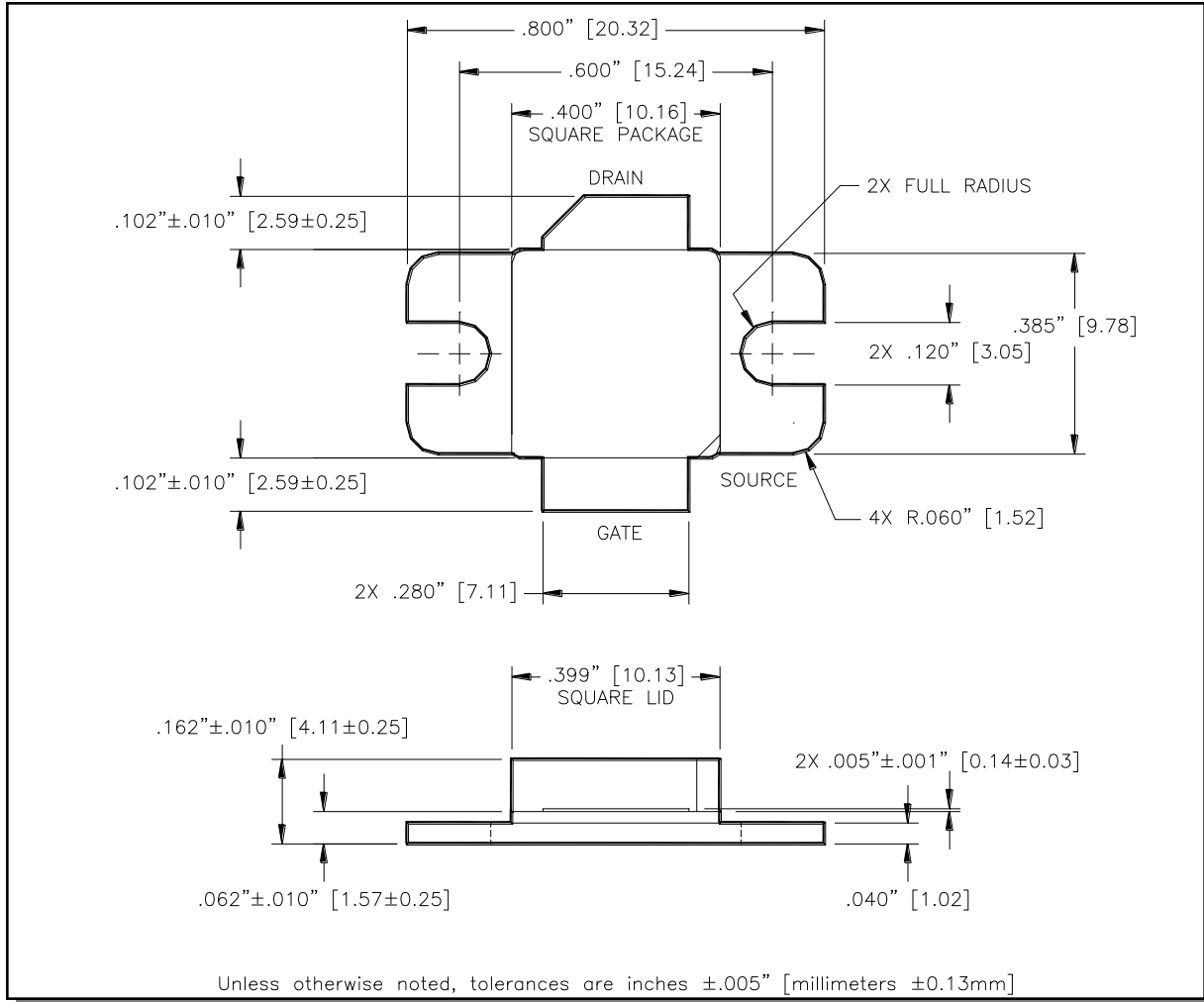
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**Outline Drawing**



**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  $V_{GS}$