



GaN on SiC HEMT Pulsed Power Transistor
125W Peak, 960-1215 MHz, 128 μ s 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: $V_{dd}=50V$, $I_{dq}=100mA$ (pulsed), $F=960-1215$ MHz, $Pulse=128\mu s$, $Duty=10\%$.

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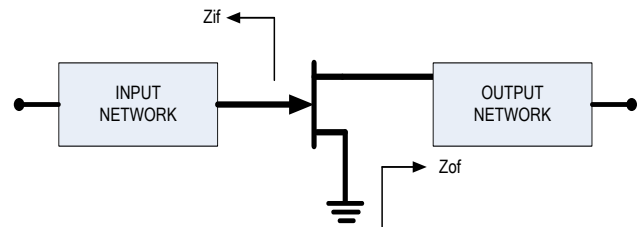
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Electrical Specifications: $T_C = 25 \pm 5^\circ\text{C}$ (Room Ambient)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Units
RF FUNCTIONAL TESTS ($V_{DD} = 50\text{V}$, $I_{DQ} = 100\text{mA}$, 128us / 10% duty, 960-1215MHz)						
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	$P_{out} = 125\text{W Peak (12.5W avg)}$	η_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} (Ω)	Z_{OF} (Ω)
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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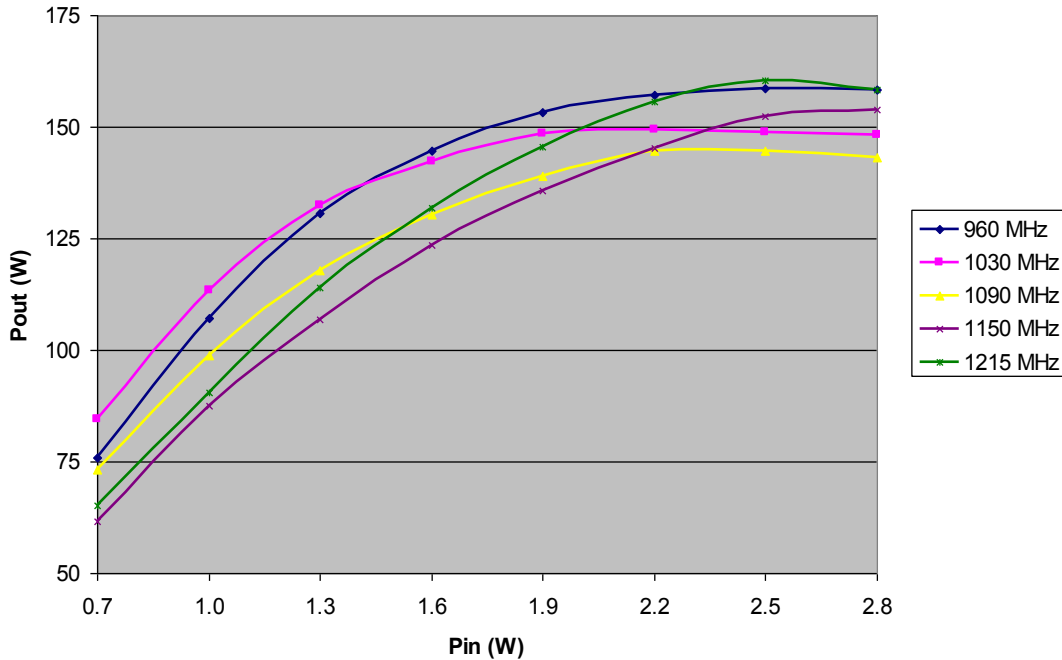
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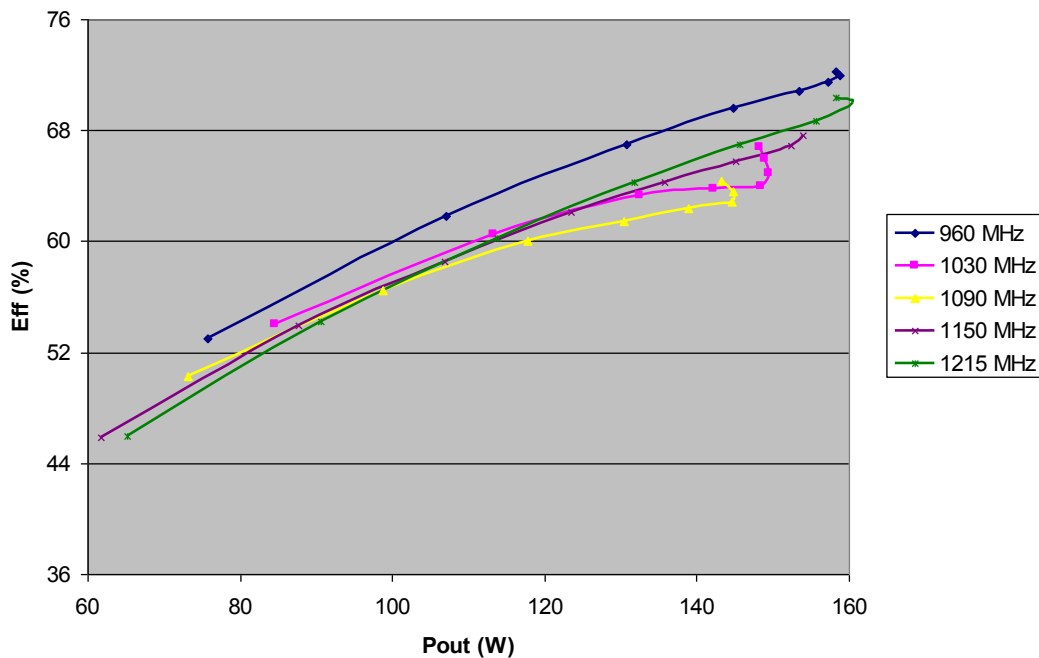
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RF Power Transfer Curve (Output Power Vs. Input Power)



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



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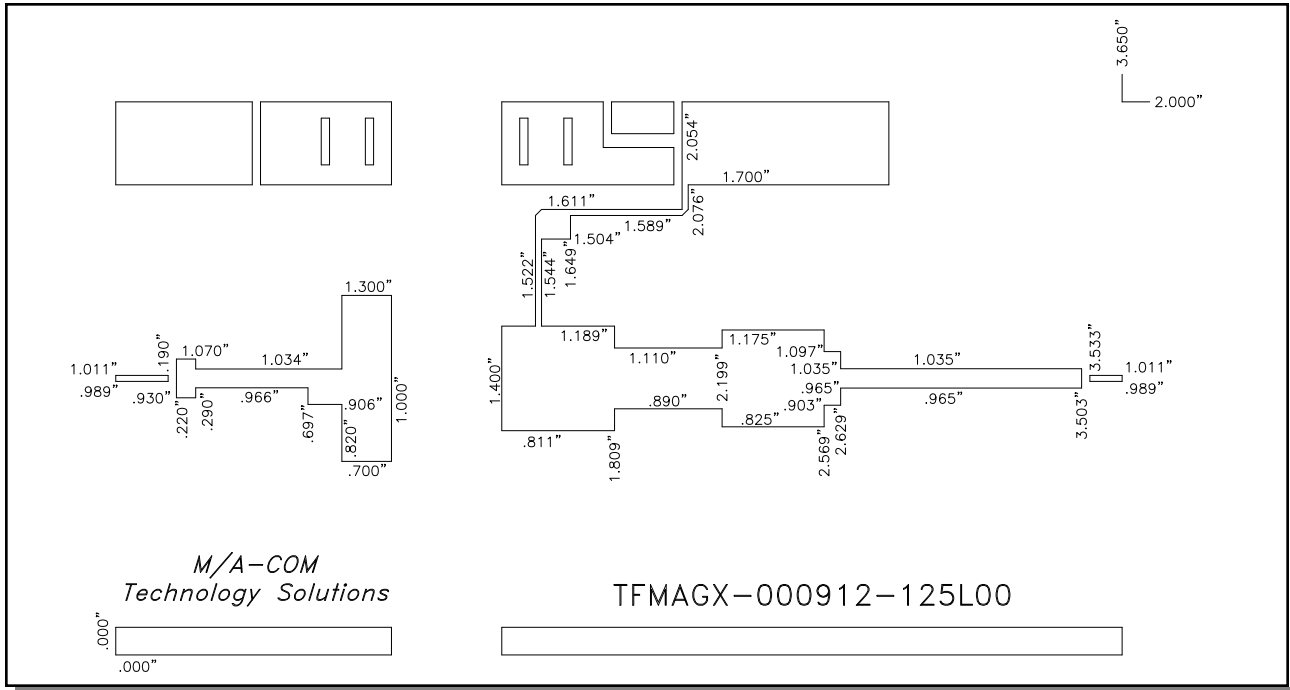
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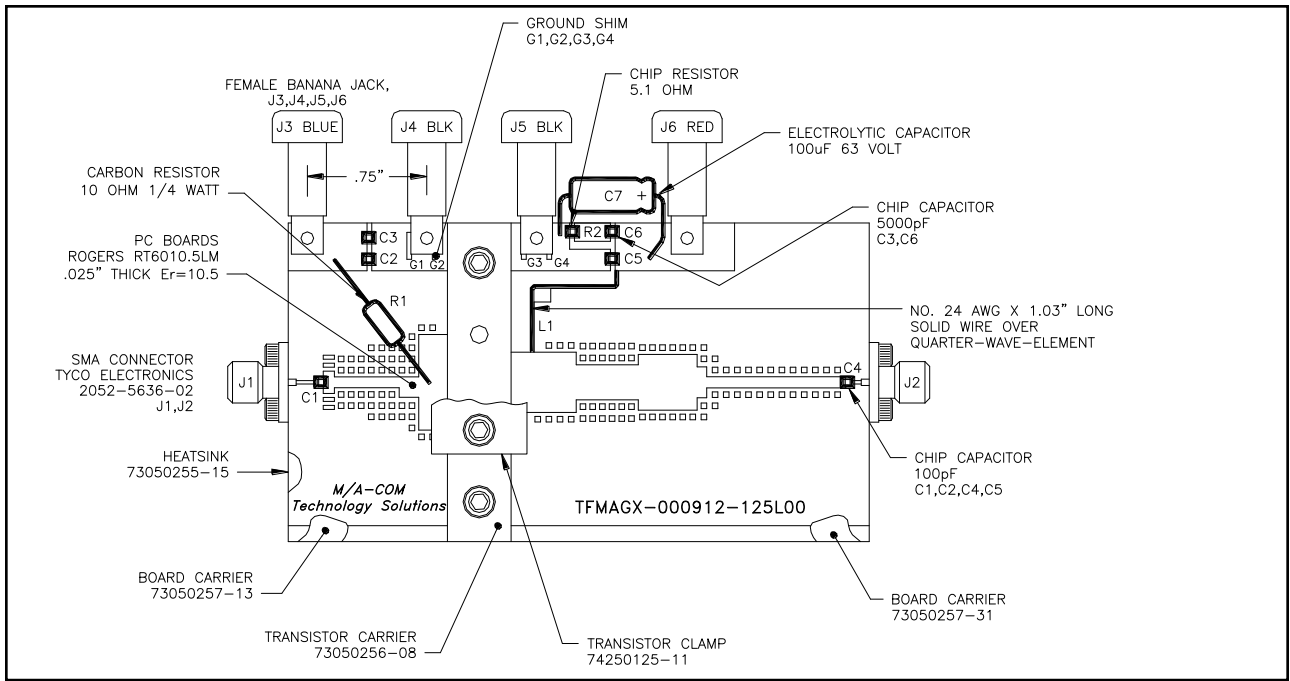
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Test Fixture Circuit Dimensions



Test Fixture Assembly



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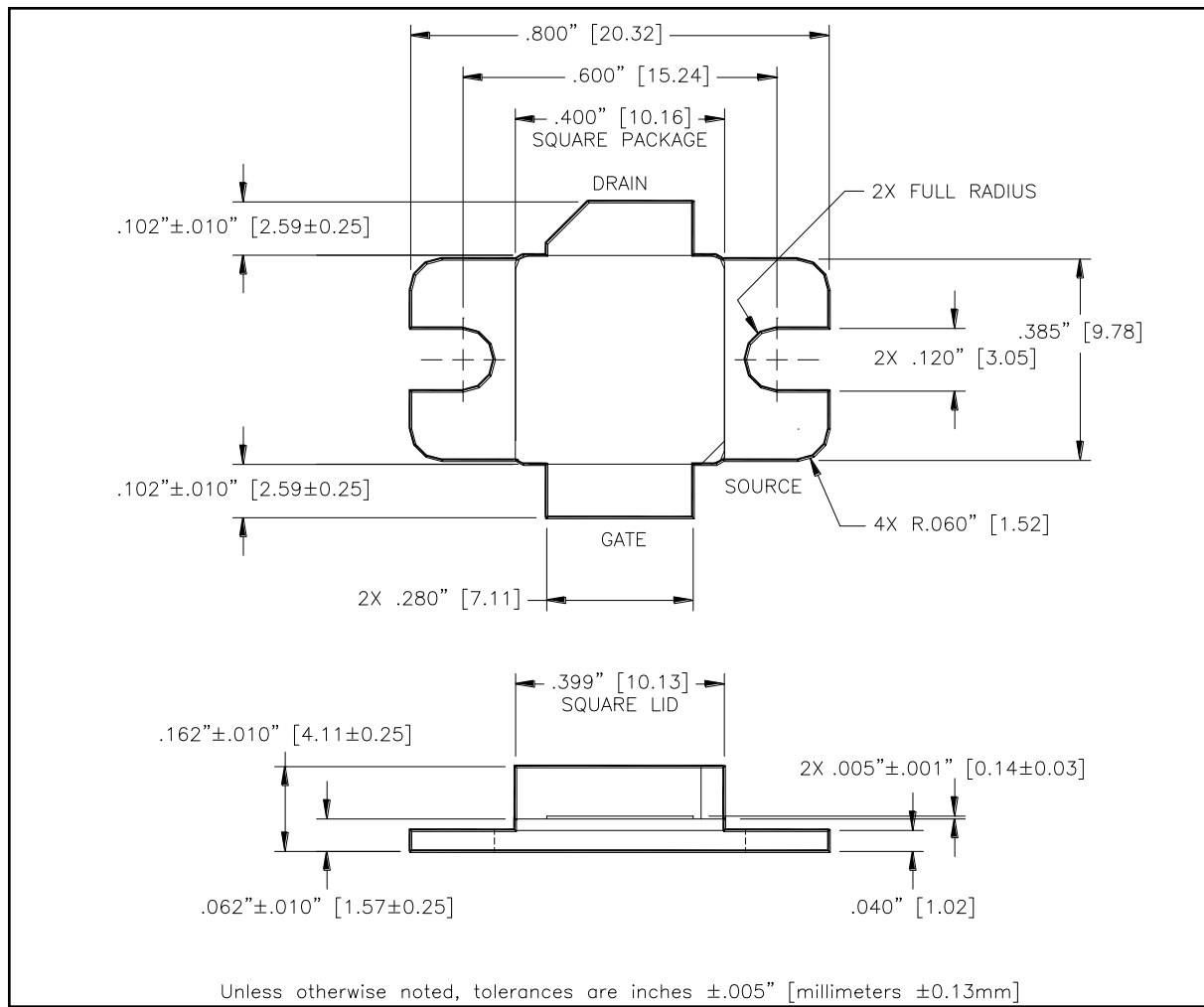
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Outline Drawing



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}