# MAGX-000912-125L00

## 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 | 200ºC |
| MTTF ($T_J$<200°C) | 114 years |
| Pulsed Power Dissipation at 85ºC | 230 Wpk |
| Thermal Resistance, (Tj = 70ºC)<br>$V_{DD}$ = 50V, $I_{DQ}$ = 100mA, Pout = 125W<br>128us Pulse / 10% Duty | 0.5ºC/W |
| Operating Temp | -40 to +95ºC |
| Storage Temp | -65 to +150ºC |
| 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*Vdd + abs(Vgg)) <175

| Parameter | Test Conditions | Symbol | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **DC CHARACTERISTICS** | | | | | | |
| Drain-Source Leakage Current | $V_{GS}$ = -8V, $V_{DS}$ = 175V | $I_{DS}$ | - | 0.2 | 6 | mA |
| Gate Threshold Voltage | $V_{DS}$ = 5V, $I_D$ = 15.0mA | $V_{GS\ (th)}$ | -5 | -3.8 | -2 | V |
| Forward Transconductance | $V_{DS}$ = 5V, $I_D$ = 3.5mA | $G_M$ | 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 | $V_{DS}$ = 50V, $V_{GS}$ = -8V, F = 1MHz | $C_{OSS}$ | - | 11 | - | pF |
| Feedback Capacitance | $V_{DS}$ = 50V, $V_{GS}$ = -8V, F = 1MHz | $C_{RSS}$ | - | 1.1 | - | pF |





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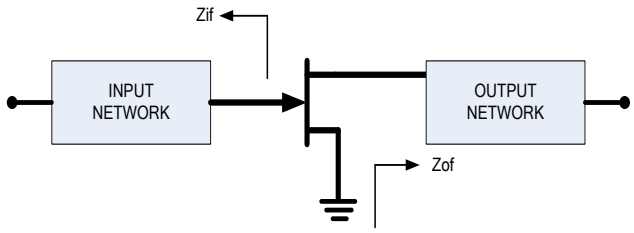
## Electrical Specifications: $T_C$ = 25 ± 5°C (Room Ambient )

| Parameter | Test Conditions | Symbol | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **RF FUNCTIONAL TESTS ($V_{DD}$ = 50V, $I_{DQ}$ = 100mA, 128us / 10% duty, 960-1215MHz)** | | | | | | |
| Input Power | Pout = 125W Peak (12.5W avg) | $P_{IN}$ | - | 1.6 | 2.2 | Wpk |
| Power Gain | Pout = 125W Peak (12.5W avg) | $G_P$ | 17.5 | 19.2 | - | dB |
| Drain Efficiency | Pout = 125W Peak (12.5W avg) | $\eta_D$ | 57 | 62 | - | % |
| Load Mismatch Stability | Pout = 125W Peak (12.5W avg) | VSWR-S | 5:1 | - | - | - |
| Load Mismatch Tolerance | Pout = 125W 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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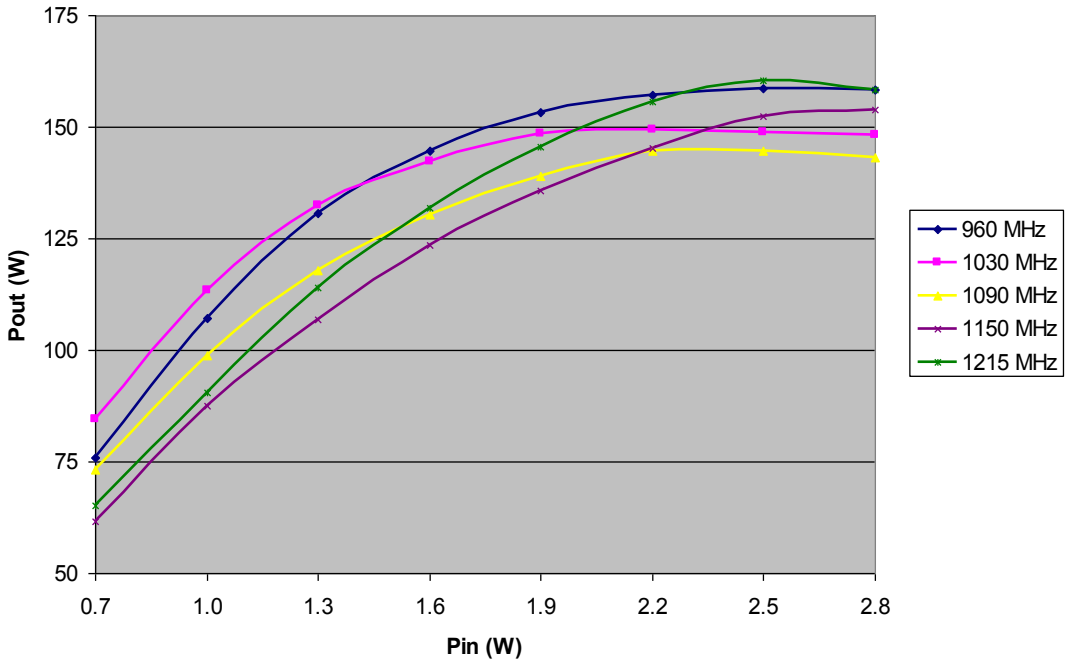
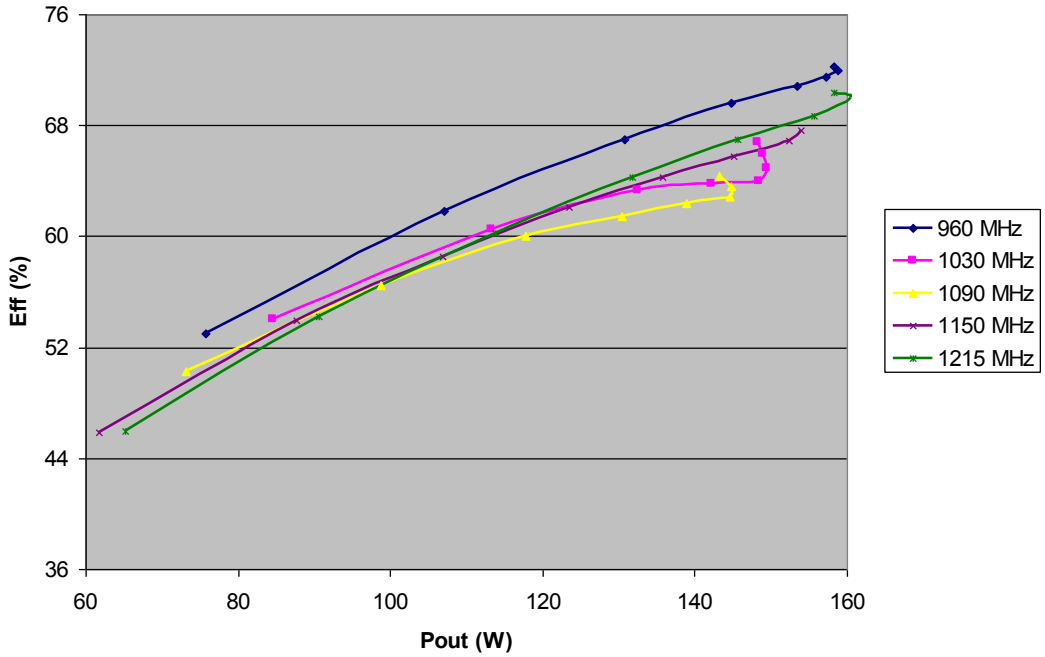
## RF Power Transfer Curve (Output Power Vs. Input Power)




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





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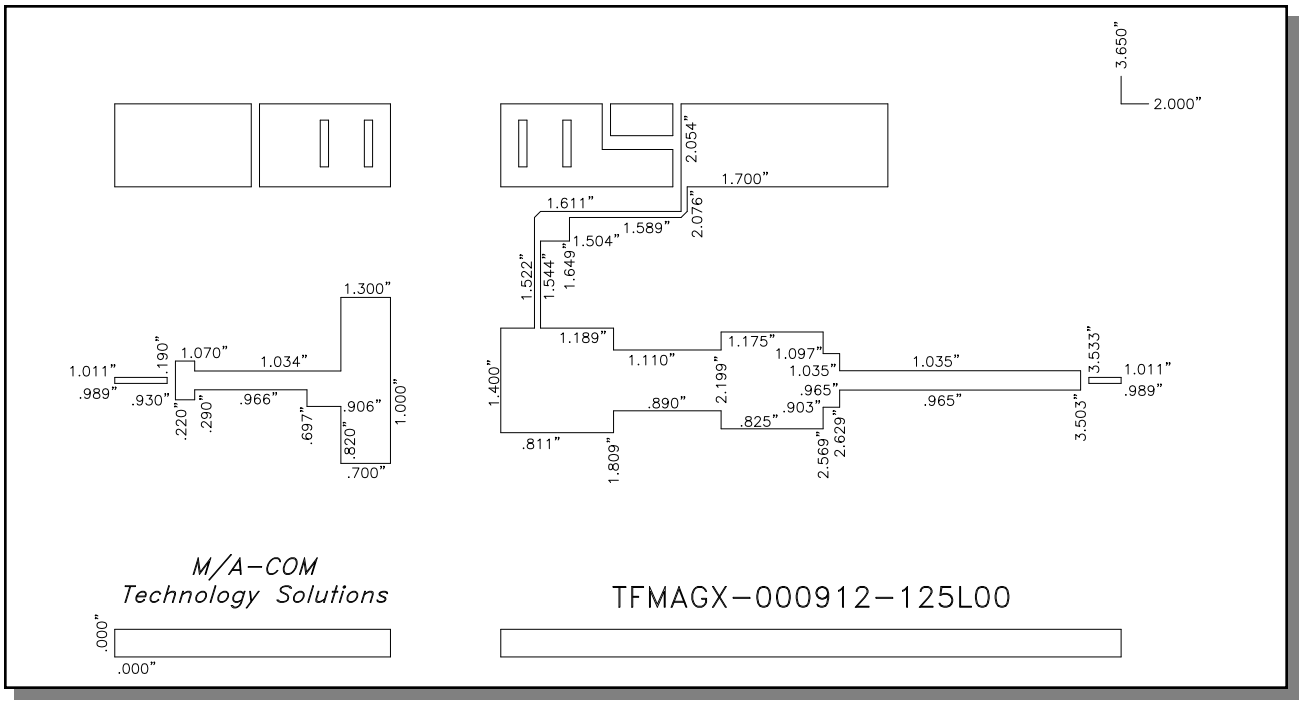
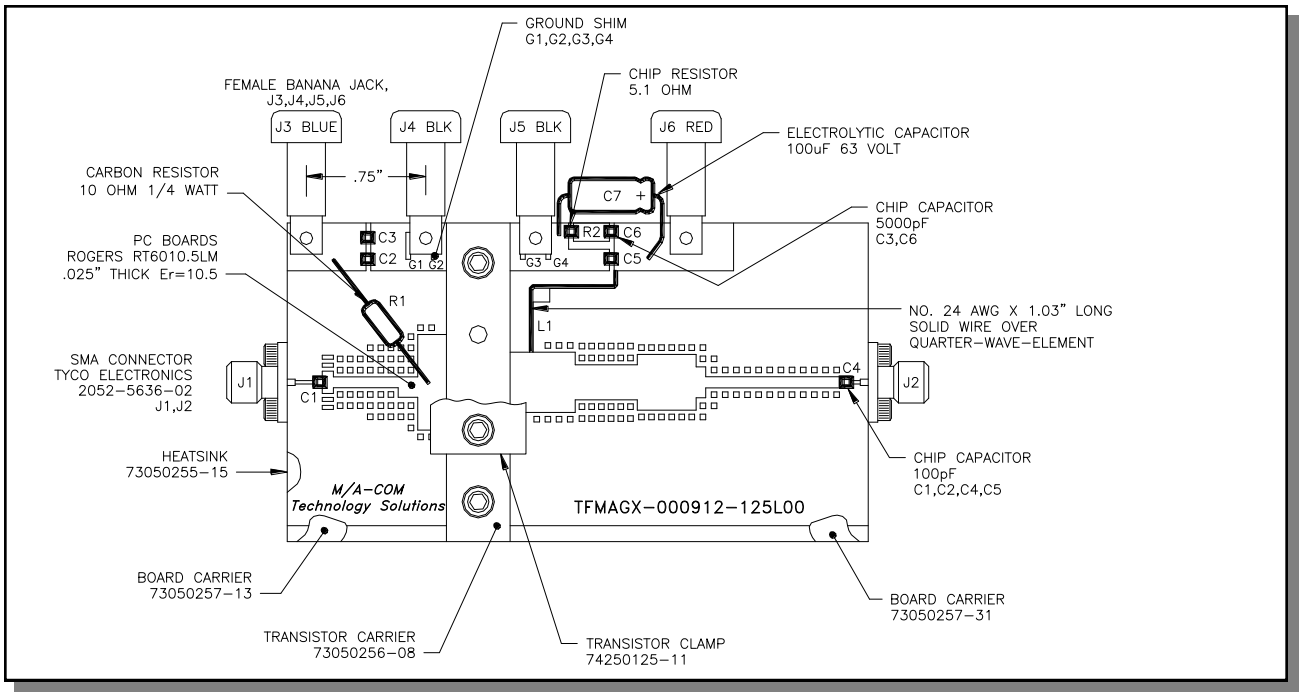
## Test Fixture Circuit Dimensions




## Test Fixture Assembly






**ADVANCED:** Data Sheets contain information regarding a product M/A-COM Technology Solutions is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.

**PRELIMINARY:** Data Sheets contain information regarding a product M/A-COM Technology Solutions has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.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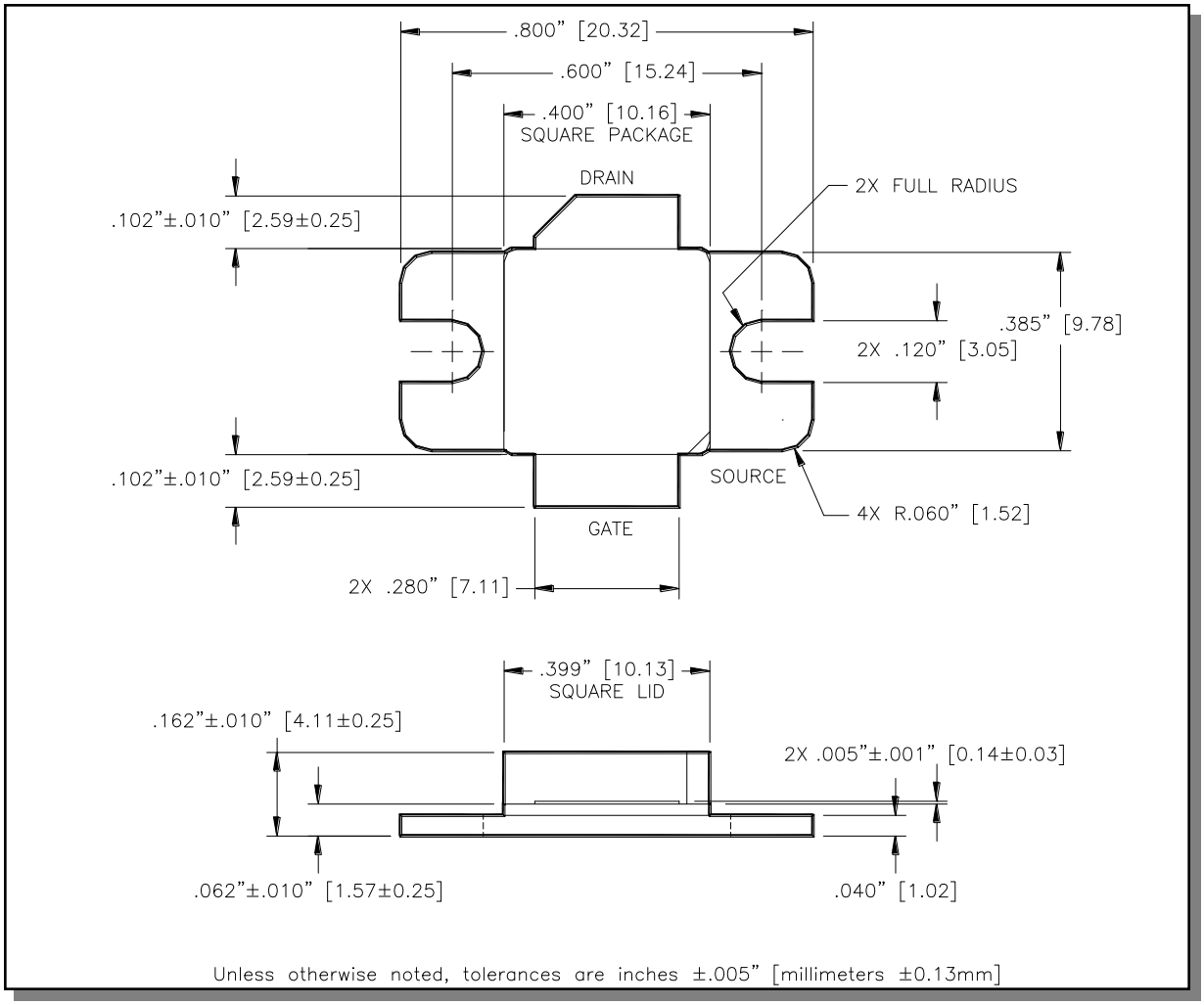
## Outline Drawing




## 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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