# MAGX-002731-180L00

## GaN HEMT Pulsed Power Transistor
## 2.7 - 3.1 GHz, 180W Peak, 300us Pulse, 10% Duty

**Production V1**
**27 Sept 11**

### Features

- GaN depletion mode HEMT microwave transistor
- Common source configuration
- Broadband Class AB operation
- Thermally enhanced Cu/Mo/Cu package
- RoHS Compliant
- +50V Typical Operation
- MTTF of 114 years (Channel Temperature < 200°C)
- **EAR99 Export Classification**


### Application

- Civilian and Military Pulsed Radar

### Product Description

The MAGX-002731-180L00 is a gold metalized matched Gallium Nitride (GaN) on Silicon Carbide RF power transistor optimized for civilian and military radar pulsed applications between 2700 - 3100 MHz. 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. The MAGX-002731-180L00 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.

### Typical Peak RF Performance

50V, 300us, 10%

| Freq (MHz) | Pin (Wpk) | Pout (Wpk) | Gain (dB) | Flat (dB) | Eff (%) | Droop (dB) |
|---|---|---|---|---|---|---|
| | | | | | | |
| 2700 | 14 | 193.6 | 11.4 | - - | 48.9 | 0.45 |
| 2800 | 14 | 208.0 | 11.7 | - - | 48.6 | 0.43 |
| 2900 | 14 | 199.3 | 11.5 | - - | 45.8 | 0.44 |
| 3000 | 14 | 199.3 | 11.5 | - - | 47.7 | 0.45 |
| 3100 | 14 | 185.8 | 11.2 | 0.52 | 47.5 | 0.41 |

50V, 500us, 10%

| Freq (MHz) | Pin (Wpk) | Pout (Wpk) | Gain (dB) | Flat (dB) | Eff (%) | Droop (dB) |
|---|---|---|---|---|---|---|
| | | | | | | |
| 2700 | 14 | 198.2 | 11.5 | - - | 50.4 | 0.58 |
| 2800 | 14 | 213.1 | 11.8 | - - | 49.9 | 0.55 |
| 2900 | 14 | 203.2 | 11.6 | - - | 46.8 | 0.58 |
| 3000 | 14 | 201.2 | 11.6 | - - | 48.8 | 0.53 |
| 3100 | 14 | 183.2 | 11.2 | 0.65 | 48.3 | 0.53 |

*Typical RF performance measured in M/A-COM RF test fixture. Devices tested in common source Class-AB configuration as follows: Vdd=50V, Idq=500mA (pulsed gate bias), F=2.7- 3.1 GHz, Pulse Width=300ms, Duty=10%.*

### Ordering Information

| | |
|---|---|
| MAGX-002731-180L00 | 180W GaN Power Transistor |
| MAGX-002731-SB3PPR | Evaluation Fixture |

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

| | |
|---|---|
| Supply Voltage (Vdd) | +65V |
| Supply Voltage (Vgg) | -8 to 0V |
| Supply Current (Id1) | 10A |
| Input Power (Pin) | +36 dBm |
| Absolute Max. Junction/Channel Temp | 200 ºC |
| Pulsed Power Dissipation (Pavg) at 85 ºC | 192 W |
| Thermal Resistance, (Tchannel = 200 ºC)<br>Pulsed 500uS, 10% Duty cycle | 0.6 ºC/W |
| Operating Temp | -40 to +95C |
| Storage Temp | -65 to +150C |
| Mounting Temperature | See solder reflow profile |
| ESD Min. - Machine Model (MM) | 50 V |
| ESD Min. - Human Body Model (HBM) | >250 V |
| 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 | $I_{DS}$ | - | - | 12 | mA |
| Gate Threshold Voltage | $V_{DS}$ = 5V, $I_D$ = 30mA | $V_{GS\ (th)}$ | -5 | -3 | -2 | V |
| Forward Transconductance | $V_{DS}$ = 5V, $I_D$ = 3.5mA | $G_M$ | 5.0 | - | - | S |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Input Capacitance | Not applicable - Input internally matched | $C_{GS}$ | N/A | N/A | N/A | pF |
| Output Capacitance | $V_{DS}$ = 50V, $V_{GS}$ = -8V, F = 1MHz | $C_{OSS}$ | - | 26.1 | 30.3 | pF |
| Reverse Transfer Capacitance | $V_{DS}$ = 50V, $V_{GS}$ = -8V, F = 1MHz | $C_{RSS}$ | - | 2.3 | 4.7 | pF |





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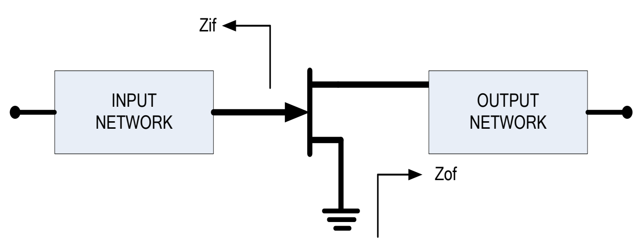
## Electrical Specifications: $T_C = 25 \pm 5°C$ (Room Ambient )

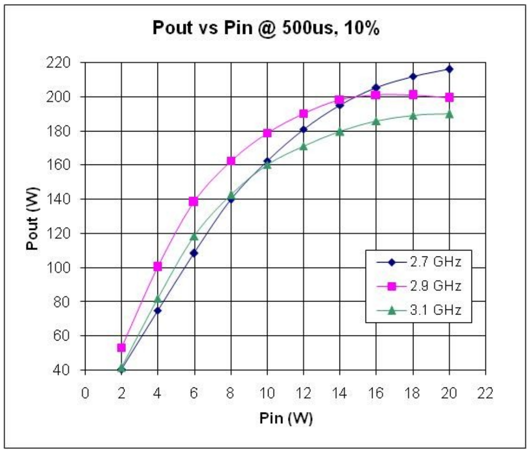
| Parameter | Test Conditions | Symbol | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **RF FUNCTIONAL TESTS** *Vdd=50V, Idq=500mA (pulsed gate bias), F=2.7- 3.1 GHz, Pulse Width=300ms, Duty=10%.* | | | | | | |
| Output Power | Pin = 14W Peak, 1.4W Ave | $P_{OUT}$ | 180<br>18 | 190<br>19 | - | W Peak<br>W Ave |
| Power Gain | Pout = 180W Peak, 18W Ave | $G_P$ | 10.5 | 11.5 | - | dB |
| Drain Efficiency | Pin = 14W Peak, 1.4W Ave | $\eta_D$ | 43 | 50 | - | % |
| Load Mismatch Stability | Pin = 14W Peak, 1.4W Ave | VSWR-S | 5:1 | - | | - |
| Load Mismatch Tolerance | Pin = 14W Peak, 1.4W Ave | VSWR-T | 10:1 | - | | - |

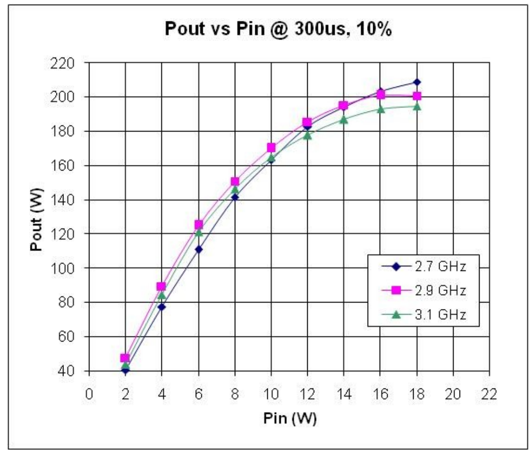
## Test Fixture Impedance

| Freq | Zif | Zof |
|---|---|---|
| 2.7 | 2.04 - j 5.75 | 2.82 - j 2.00 |
| 2.8 | 1.61 - j 5.40 | 3.08 - j 2.73 |
| 2.9 | 1.28 - j 4.98 | 2.88 - j 3.30 |
| 3.0 | 1.13 - j 4.51 | 2.49 - j 3.49 |
| 3.1 | 1.19 - j 4.18 | 2.21 - j 3.64 |

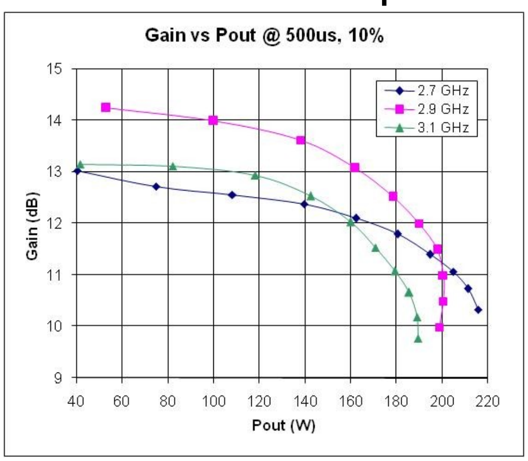


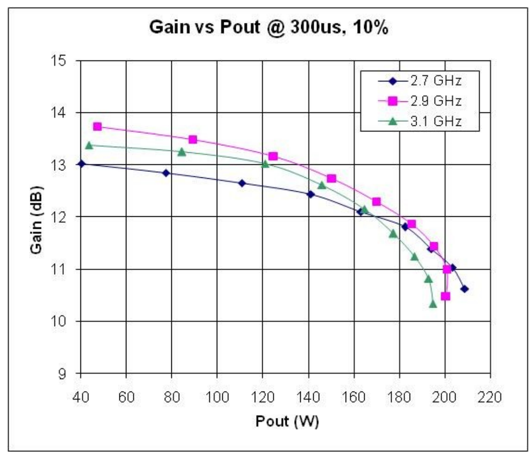
## RF Power Transfer Curve
## Peak Output Power vs. Input Power



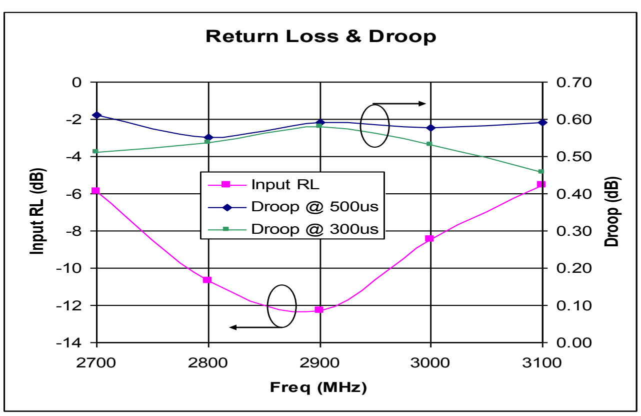




## RF Power Transfer Curve
## Power Gain vs. Peak Output Power




## Input VSWR & Droop (Typ)



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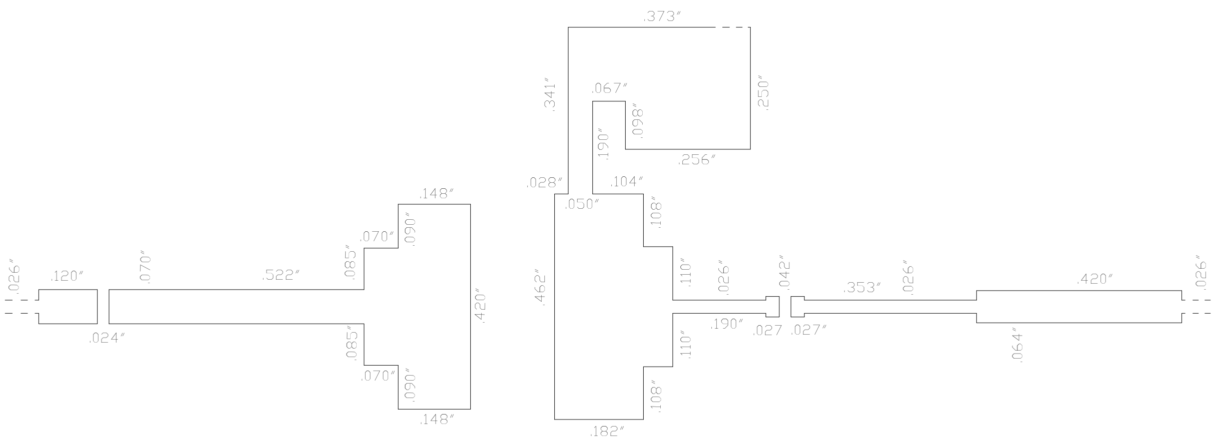
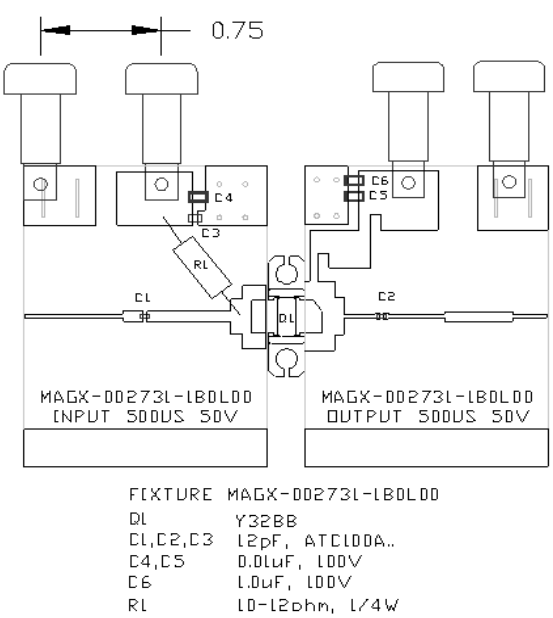
## Test Fixture Circuit Dimensions (inches)




## Test Fixture Assembly





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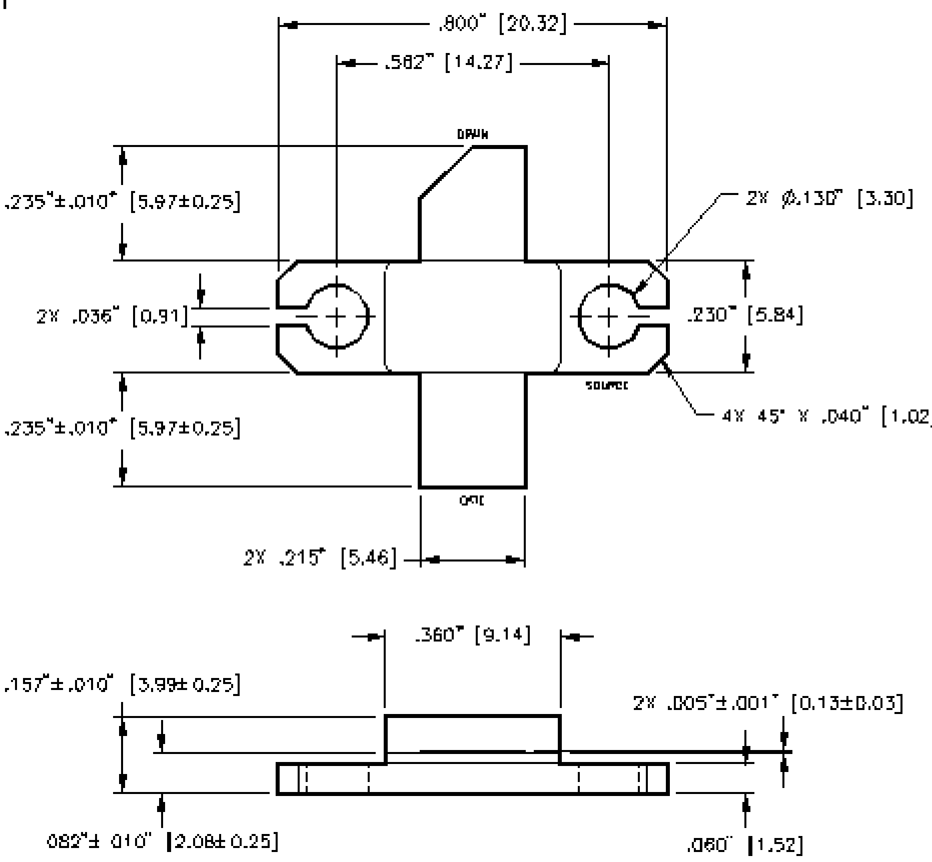
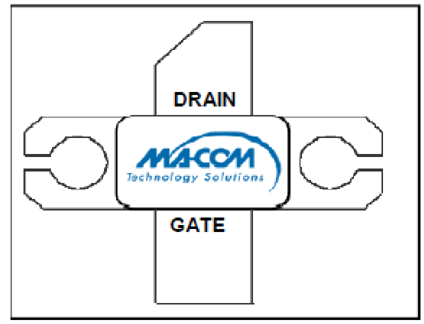
## Outline Drawing




## 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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