

**MAGX-000035-010000**

**MAGX-000035-01000S**

**GaN on SiC HEMT Power Transistor**  
**10W CW, 30 MHz - 3.5 GHz**

**Rev. V3**

## Features

- GaN Depletion-Mode HEMT Microwave Transistor
- Common-Source configuration
- No internal matching
- Broadband Class AB operation
- RoHS\* Compliant
- +50 V Typical Operation
- MTTF = 600 years

## Description

The MAGX-000035-01000X is a gold-metalized unmatched Gallium Nitride (GaN) on Silicon Carbide RF power transistor suitable for a variety of RF power amplifier applications. Using state of the art wafer fabrication processes, these high performance transistors provide high gain, efficiency, bandwidth, and ruggedness over multiple octave bandwidths for today's demanding application needs.

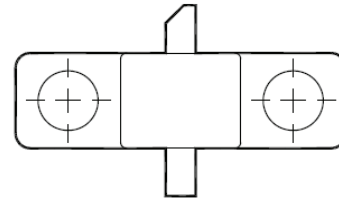
The MAGX-000035-01000X is constructed with either a flanged or flangeless ceramic package which provides excellent thermal performance. High breakdown voltages allow for reliable and stable operation in extreme mismatched load conditions compared with older semiconductor technologies.

## Applications

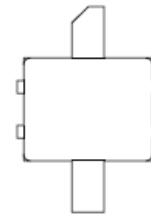
General purpose for pulsed or CW applications:

- Commercial Wireless Infrastructure (WCDMA, LTE, WIMAX)
- Civilian and Military Radar
- Military and Commercial Communications
- Public Radio
- Industrial, Scientific and Medical
- SATCOM
- Instrumentation
- Avionics

## MAGX-000035-010000 (Flanged)



## MAGX-000035-01000S (Flangeless)



## Ordering Information

| Part Number        | Package                                   |
|--------------------|-------------------------------------------|
| MAGX-000035-010000 | 10 W GaN Power Transistor (Flanged)       |
| MAGX-000035-01000S | 10 W GaN Power Transistor (Flangeless)    |
| MAGX-000035-SB2PPR | 1.2-1.4 GHz Evaluation Board (Flanged)    |
| MAGX-000035-SB3PPR | 1.2-1.4 GHz Evaluation Board (Flangeless) |

\* Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

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## Absolute Maximum Ratings<sup>1, 2, 3</sup>

| Parameter                                                                         | Limit         |
|-----------------------------------------------------------------------------------|---------------|
| Supply Voltage ( $V_{DD}$ )                                                       | +65 V         |
| Supply Voltage ( $V_{GG}$ )                                                       | -8 to 0 V     |
| Supply Current ( $I_{DD}$ )                                                       | 800 mA        |
| Input Power ( $P_{IN}$ )                                                          | 25 dBm        |
| Junction/Channel Temp                                                             | 200°C         |
| MTTF ( $T_J < 200\text{ °C}$ )                                                    | 600 years     |
| Continuous Power Dissipation ( $P_{DISS}$ ) at 85 °C                              | 18 W          |
| Pulsed Power Dissipation ( $P_{AVG}$ ) at 85 °C                                   | 43 W          |
| Thermal Resistance, ( $T_J = 200\text{ °C}$ ), CW                                 | 9.2 °C/W      |
| Thermal Resistance, ( $T_J = 200\text{ °C}$ ), Pulsed 500 $\mu$ s, 10% Duty cycle | 3.4 °C/W      |
| Operating Temp                                                                    | -40 to +95°C  |
| Storage Temp                                                                      | -65 to +150°C |
| ESD Min. - Charged Device Model (CDM)                                             | 250 V         |
| ESD Min. - Human Body Model (HBM)                                                 | 250 V         |

1. Exceeding any one or combination of these limits may cause permanent damage to this device
2. Junction temperature directly affects device MTTF. Junction temperature should be kept as low as possible to maximize lifetime.
3. For saturated performance it is recommended that the sum of ( $3 \cdot V_{DD} + \text{abs}(V_{GG})$ ) < 175 V.

## DC Characteristics

| Parameter                    | Test Conditions                                  | Symbol       | Min. | Typ. | Max. | Units |
|------------------------------|--------------------------------------------------|--------------|------|------|------|-------|
| Drain-Source Leakage Current | $V_{GS} = -8\text{ V}$ , $V_{DS} = 175\text{ V}$ | $I_{DS}$     | -    | -    | 10.8 | mA    |
| Gate Threshold Voltage       | $V_{DS} = 5\text{ V}$ , $I_D = 2\text{ mA}$      | $V_{GS(TH)}$ | -5   | -3   | -2   | V     |
| Forward Transconductance     | $V_{DS} = 5\text{ V}$ , $I_D = 500\text{ mA}$    | $G_M$        | 5.5  | -    | -    | S     |

## DC Characteristics

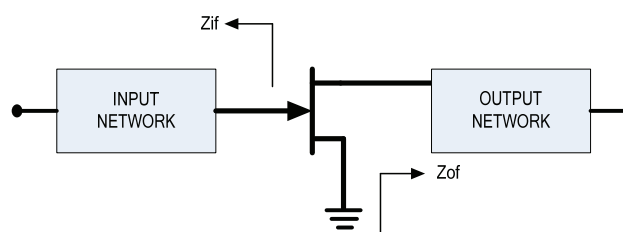
| Parameter                    | Test Conditions                                                      | Symbol    | Min. | Typ. | Max. | Units |
|------------------------------|----------------------------------------------------------------------|-----------|------|------|------|-------|
| Input Capacitance            | $V_{DS} = 0\text{ V}$ , $V_{GS} = -8\text{ V}$ , $F = 1\text{ MHz}$  | $C_{ISS}$ | -    | 4.4  | -    | pF    |
| Output Capacitance           | $V_{DS} = 50\text{ V}$ , $V_{GS} = -8\text{ V}$ , $F = 1\text{ MHz}$ | $C_{OSS}$ | -    | 1.9  | -    | pF    |
| Reverse Transfer Capacitance | $V_{DS} = 50\text{ V}$ , $V_{GS} = -8\text{ V}$ , $F = 1\text{ MHz}$ | $C_{RSS}$ | -    | 0.2  | -    | pF    |

**Electrical Specifications:  $T_A = 25\text{ }^{\circ}\text{C}$**

| Parameter                         | Test Conditions                                                            | Symbol    | Min. | Typ. | Max. | Units |
|-----------------------------------|----------------------------------------------------------------------------|-----------|------|------|------|-------|
| <b>RF FUNCTIONAL TESTS</b>        |                                                                            |           |      |      |      |       |
| CW Output Power (P2dB)<br>1.3 GHz | $V_{DD} = 50\text{ V}$ , $I_{DQ} = 25\text{ mA}$ , $P_{IN} = 0.3\text{ W}$ | $P_{OUT}$ | 10   | 11   | -    | W     |
| Power Gain (P2dB) 1.3 GHz         | $V_{DD} = 50\text{ V}$ , $I_{DQ} = 25\text{ mA}$                           | $G_P$     | 18   | 19   |      | dB    |
| Drain Efficiency @ 1.3 GHz        | $V_{DD} = 50\text{ V}$ , $I_{DQ} = 25\text{ mA}$ , $P_{OUT} = 10\text{ W}$ | $\eta_D$  |      | 45   |      | %     |
| Load Mismatch Stability           | $V_{DD} = 50\text{ V}$ , $I_{DQ} = 25\text{ mA}$ , $P_{IN} = 0.3\text{ W}$ | VSWR-S    | 5:1  | -    | -    | -     |
| Load Mismatch Tolerance           | $V_{DD} = 50\text{ V}$ , $I_{DQ} = 25\text{ mA}$ , $P_{IN} = 0.3\text{ W}$ | VSWR-T    | 10:1 | -    | -    | -     |

**Test Fixture Impedance**

| Freq. (MHz) | $Z_{IN-OPT}\text{ }(\Omega)$ | $Z_{OUT-OPT}\text{ }(\Omega)$ |
|-------------|------------------------------|-------------------------------|
| <b>1300</b> | $3.6 + j6.9$                 | $38.3 + j20.5$                |



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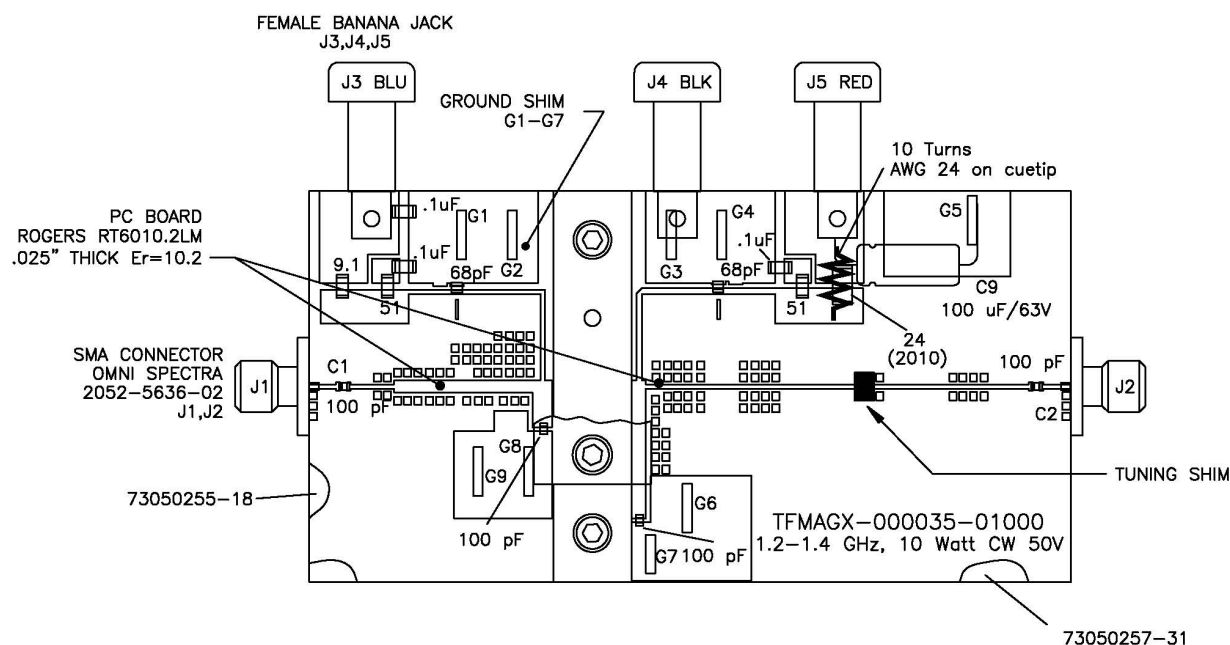
### 1.2—1.4 GHz Typical CW Performance

| Freq. (GHz) | P <sub>OUT</sub> (dBm) | P <sub>OUT</sub> (W) | Gain (dB) | I <sub>D</sub> (A) | Eff. (%) | V <sub>D</sub> (V) | I <sub>DQ</sub> (mA) |
|-------------|------------------------|----------------------|-----------|--------------------|----------|--------------------|----------------------|
| 1.20        | 40.0                   | 10.0                 | 17.5      | 0.49               | 41       | 50                 | 25                   |
| 1.30        | 40.0                   | 10.0                 | 18.4      | 0.40               | 44       | -                  | -                    |
| 1.40        | 40.0                   | 10.0                 | 17.8      | 0.50               | 40       | -                  | -                    |

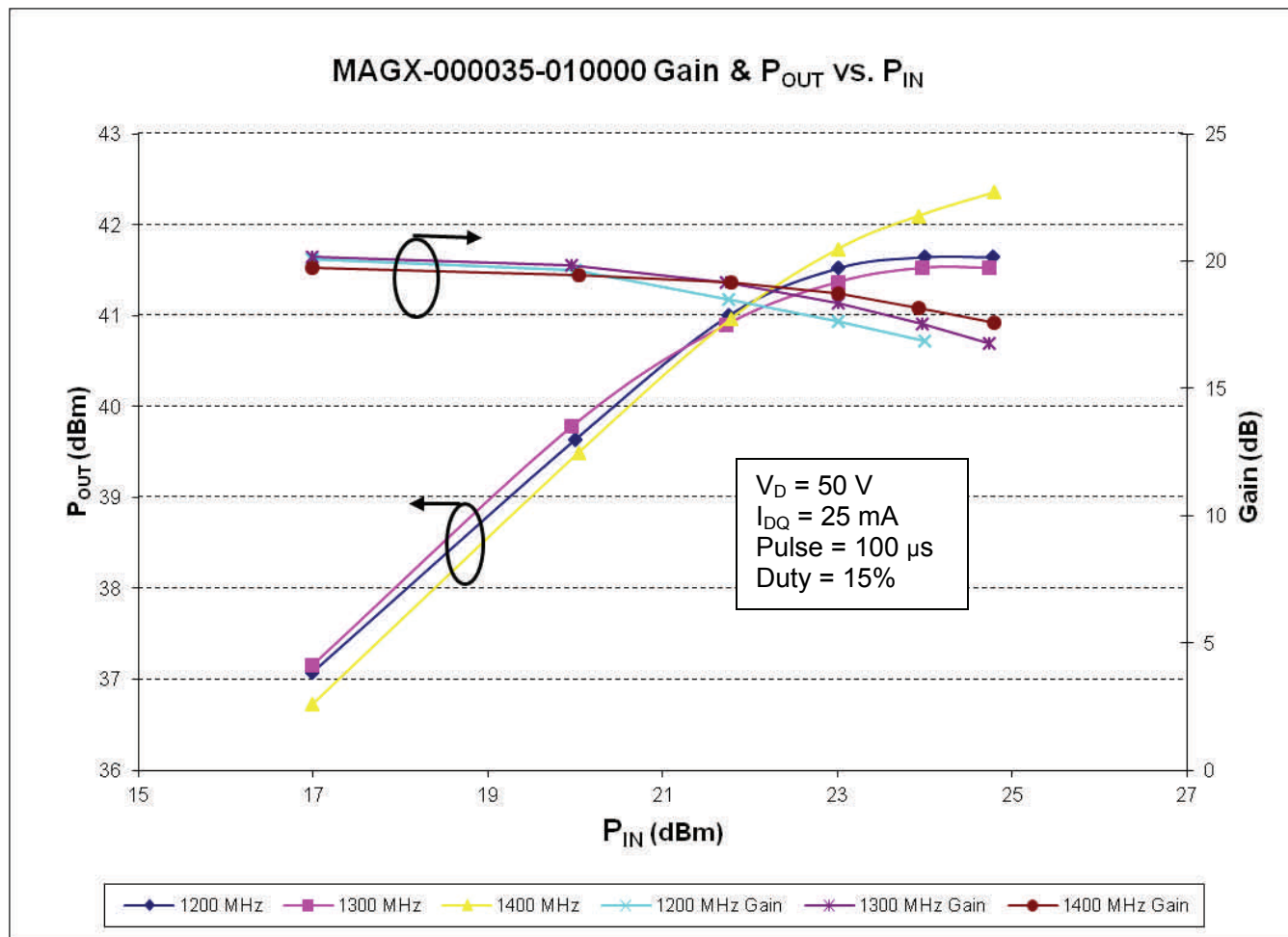
### 3.3 GHz Typical CW Performance

| Freq. (GHz) | P <sub>2dB</sub> (dBm) | P <sub>OUT</sub> (W) | Gain (dB) | I <sub>D</sub> (A) | Eff. (%) | V <sub>D</sub> (V) | I <sub>DQ</sub> (mA) |
|-------------|------------------------|----------------------|-----------|--------------------|----------|--------------------|----------------------|
| 3.30        | 40.3                   | 10.7                 | 16.2      | 0.38               | 57       | 50                 | 25                   |

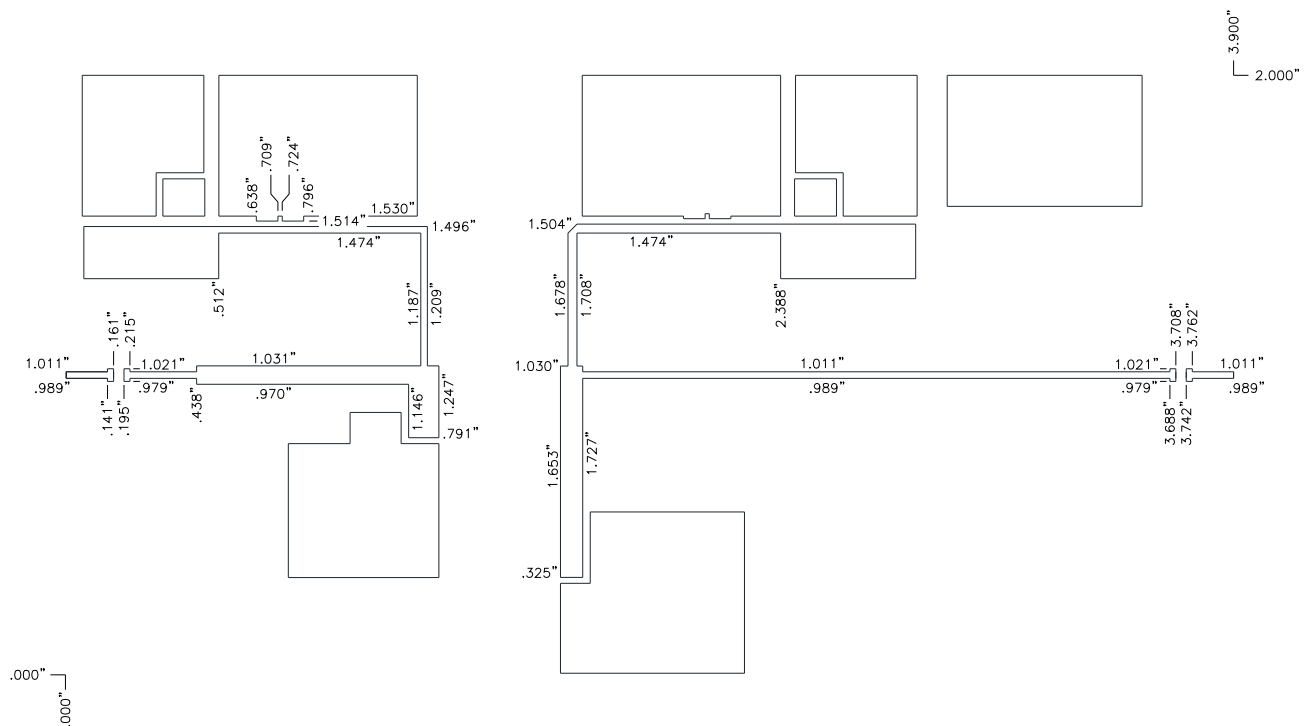
### 1.2—1.4 GHz Test Fixture



## 1.2—1.4 GHz Performance With Pulsed Signal



## 1.2—1.4 GHz Matching Circuit For Rogers RT6010.2LM



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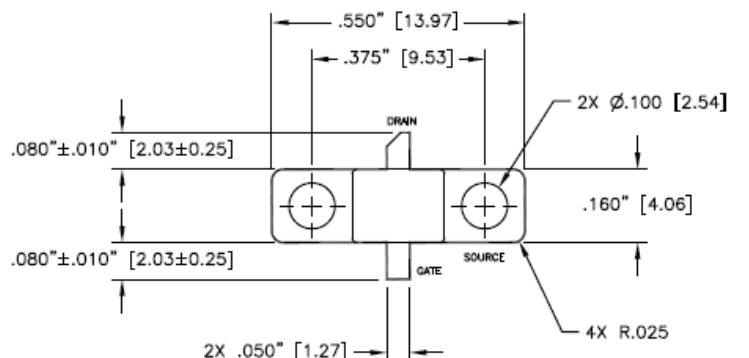
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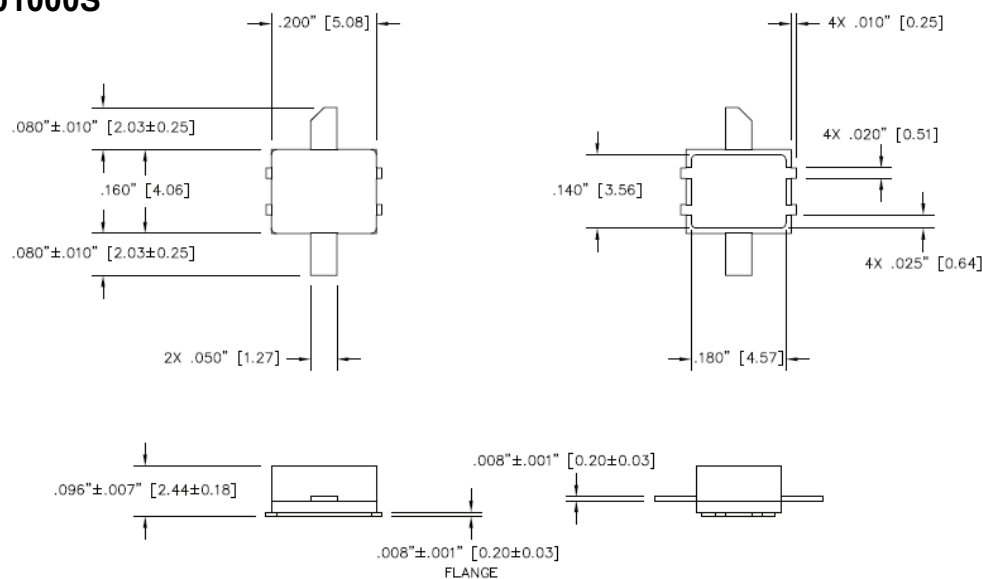
Rev. V3

## Outline Drawings

### MAGX-000035-010000



### MAGX-000035-01000S



Unless otherwise noted, tolerances are inches  $\pm$ .005" [millimeters  $\pm$ 0.13mm]

## **CORRECT DEVICE SEQUENCING**

### **TURNING THE DEVICE ON**

1. Set  $V_{GS}$  to the pinch-off ( $V_P$ ), typically -5 V.
2. Turn on  $V_{DS}$  to nominal voltage (50 V).
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 0 V.
4. Turn off  $V_{GS}$ .