

MAGX-000035-015000

MAGX-000035-01500S



GaN on SiC HEMT Pulsed Power Transistor
15 W, DC - 3.5 GHz

Rev. V1

Features

- GaN on SiC Depletion Mode Transistor
- Common-Source Configuration
- Broadband Class AB Operation
- Thermally Enhanced Package (Flanged: Cu/W, Flangeless: Cu)
- RoHS* Compliant
- +50V Typical Operation
- MTTF = 600 years ($T_J < 200^\circ\text{C}$)

Primary Applications

- Commercial Wireless Infrastructure (WCDMA, LTE, WiMAX)
- Air Traffic Control Radar - Commercial
- Weather Radar - Commercial
- Military Radar - Military
- Public Radio
- Industrial, Scientific and Medical
- SATCOM
- Instrumentation

Description

The MAGX-000035-01500X 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-000035-01500X is constructed using a thermally enhanced flanged (Cu/W) or flangeless (Cu) 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.

MAGX-000035-015000 (Flanged)



MAGX-000035-01500S (Flangeless)



Ordering Information

Part Number	Description
MAGX-000035-015000	Flanged, Bulk Packaging
MAGX-000035-01500S	Flangeless, Bulk Packaging
MAGX-L20035-015000	Sample Board (1.2 - 1.4 GHz, Flanged)
MAGX-L20035-01500S	Sample Board (1.2 - 1.4 GHz, Flangeless)

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

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Electrical Specifications¹: Freq. = 1.2 - 1.4 GHz, $T_A = 25^\circ\text{C}$

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
RF Functional Tests: $V_{DD} = 50\text{ V}$, $I_{DQ} = 15\text{ mA}$, 1 ms Pulse, 10% Duty						
Output Power	$P_{IN} = 0.5\text{ W}$	P_{OUT}	15.0	17.7	-	W
Power Gain	$P_{IN} = 0.5\text{ W}$	G_P	14.8	15.5	-	dB
Drain Efficiency	$P_{IN} = 0.5\text{ W}$	η_D	55	63	-	%
Droop	$P_{IN} = 0.5\text{ W}$	Droop	-	0.1	0.4	dB
Load Mismatch Stability	$P_{IN} = 0.5\text{ W}$	VSWR-S	-	5:1	-	-
Load Mismatch Tolerance	$P_{IN} = 0.5\text{ W}$	VSWR-T	-	10:1	-	-

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

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}	-	-	750	μA
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	0.35	-	-	S
Dynamic Characteristics						
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

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 (+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 0 V.
4. Turn off V_{GS} .

1. Electrical Specifications measured in MACOM RF evaluation board.

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Absolute Maximum Ratings^{2,3,4}

Parameter	Absolute Max.
Input Power	P_{IN} (nominal) + 3 dB
Drain Supply Voltage, V_{DD}	+65 V
Gate Supply Voltage, V_{GG}	-8 V to 0 V
Supply Current, I_{DD}	800 mA
Power Dissipation (P_{AVG}), Pulsed @ 85°C	10.3 W
MTTF ($T_J < 200^\circ\text{C}$)	600 years
Junction Temperature ⁵	200°C
Operating Temperature	-40°C to +95°C
Storage Temperature	-65°C to +150°C
Mounting Temperature	See solder reflow profile
ESD Min. - Charged Device Model (CDM)	150 V
ESD Min. - Human Body Model (HBM)	500 V

2. Operation of this device above any one of these parameters may cause permanent damage.
3. Channel temperature directly affects a device's MTTF. Channel temperature should be kept as low as possible to maximize lifetime.
4. For saturated performance it is recommended that the sum of $(3 \cdot V_{DD} + \text{abs}(V_{GG})) < 175 \text{ V}$.
5. Junction Temperature (T_J) = $T_C + \Theta_{JC} \cdot ((V \cdot I) - (P_{OUT} - P_{IN}))$

Typical transient thermal resistances:

1 ms pulse, 10% duty cycle, $\Theta_{JC} = 5.0^\circ\text{C/W}$

For $T_C = 85^\circ\text{C}$,

$T_J = 132^\circ\text{C}$ @ 50 V, 520 mA-pk, $P_{OUT} = 17.0 \text{ W}$, $P_{IN} = 0.5 \text{ W}$

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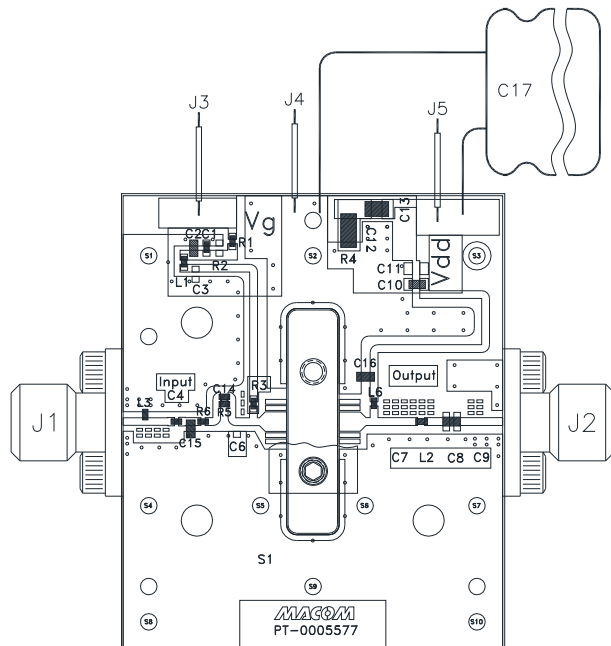
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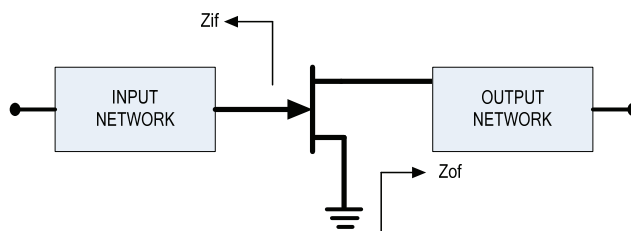
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Test Fixture Assembly (1.2 - 1.4 GHz, 1 ms Pulse, 10% Duty, $V_{DD} = 50$ V, $I_{dq} = 15$ mA)



Test Fixture Impedances

F (GHz)	Z_{IF} (Ω)	Z_{OF} (Ω)
1.2	$1.4 + j3.5$	$2.5 + j3.5$
1.3	$1.3 + j3.8$	$2.7 + j3.9$
1.4	$1.8 + j4.0$	$3.1 + j4.2$



Parts List

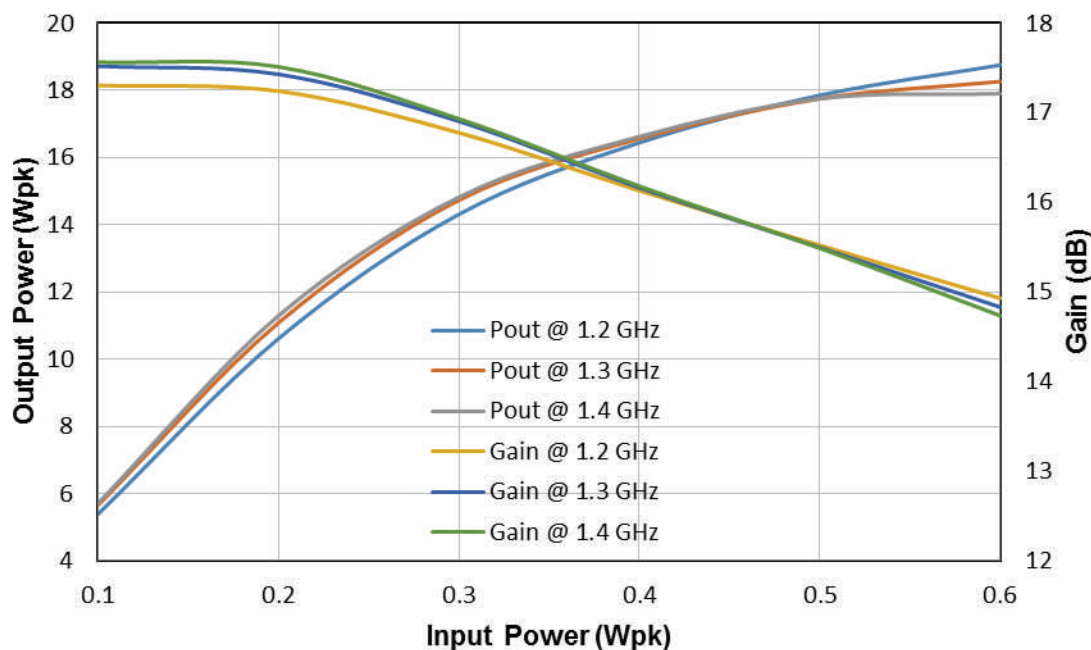
Reference Designator	Part	Vendor
C4	0402, 5.1 pF, ± 0.1 pF	ATC
C15	0603, 6.8 pF, ± 0.1 pF	ATC
C2	0603, 82 pF, $\pm 10\%$	ATC
C16	0603, 100 pF, $\pm 10\%$	ATC
C1, C10	0402, 1000 pF, 100 V, 5%	ATC
C8	0603, 30 pF, $\pm 10\%$	ATC
C13	0805, 1 μ F, 100 V, $\pm 20\%$	ATC
C14	0402, 12 pF, $\pm 10\%$	ATC
C17	100 μ F, 160 V, Electrolytic Capacitor	Panasonic
C3, C6, C7, C9, C11, C12, R2	Do Not Populate	-
R3	240 Ω , 0603, 5%	Panasonic
L1, R1	1.0 Ω , 0402, 5%	Panasonic
R4	1.0 Ω , 1206, 5%	Panasonic
R5	10 Ω , 0402, 5%	Panasonic
L3, L6	0402, 3.9 nH, 2%	Coilcraft
L2, R6	0402, 0.0 Ω Resistor	Panasonic
J1, J2	SMA Connector	Tyco Electronics

Application Section

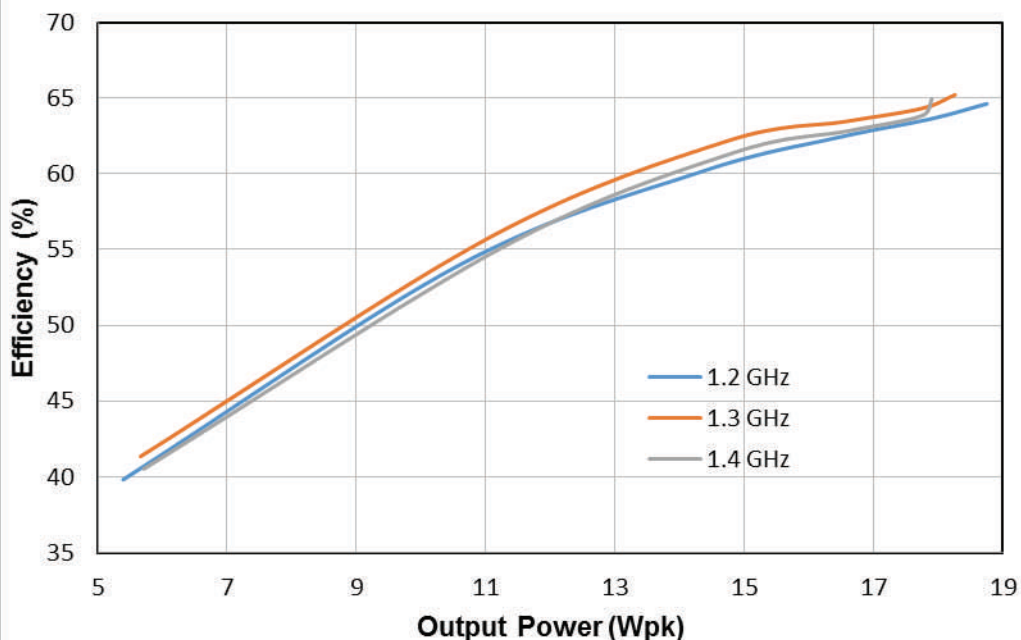
Typical Performance Curves

1.2 - 1.4 GHz, 1 ms Pulse, 10% Duty, $V_{DD} = 50$ V, $I_{dQ} = 15$ mA, $T_A = 25^\circ\text{C}$

Output Power and Gain Vs. Input Power



Drain Efficiency Vs. Output Power



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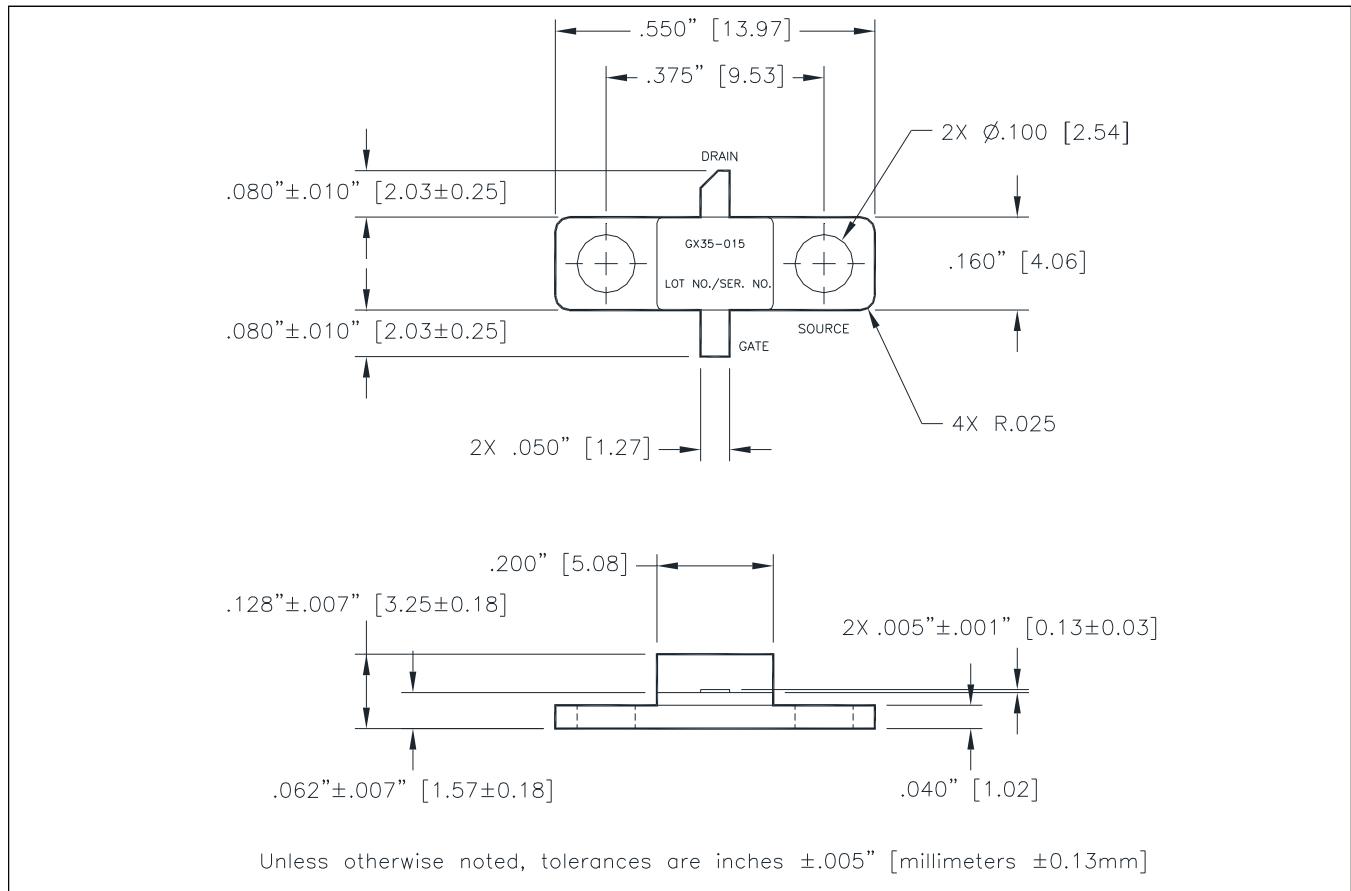
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Outline Drawing MAGX-000035-015000 (Flanged)



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Outline Drawing MAGX-000035-01500S (Flangeless)

