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 ($T_J < 200°C$)

Primary Applications

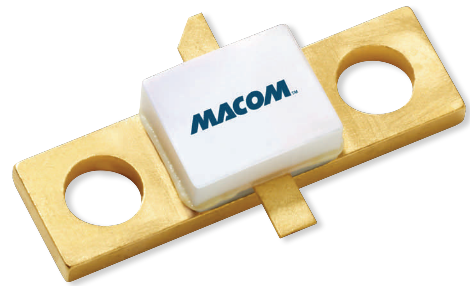
- Commercial Wireless Infrastructure (WCDMA, LTE, WiMAX)
- Air Traffic Control Radar - Commercial
- Weather Radar - Commercial
- Military Radar - Military
- Public Radio
- Industrial, Scientific and Medical
- SATCOM
- Instrumentation

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)

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

- **North America** Tel: 800.366.2266 / Fax: 978.366.2266
- **Europe** Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- **Asia/Pacific** Tel: 81.44.844.8296 / Fax: 81.44.844.8298

Electrical Specifications[1]: Freq. = 1.2 - 1.4 GHz, T_A = 25°C

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

Electrical Characteristics: T_A = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
DC Characteristics						
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 175 V	I_{DS}	-	-	750	μA
Gate Threshold Voltage	V_{DS} = 5 V, I_D = 2 mA	$V_{GS\ (TH)}$	-5	-3	-2	V
Forward Transconductance	V_{DS} = 5 V, I_D = 500 mA	G_M	0.35	-	-	S
Dynamic Characteristics						
Input Capacitance	V_{DS} = 0 V, V_{GS} = -8 V, F = 1 MHz	C_{ISS}	-	4.4	-	pF
Output Capacitance	V_{DS} = 50 V, V_{GS} = -8 V, F = 1 MHz	C_{OSS}	-	1.9	-	pF
Reverse Transfer Capacitance	V_{DS} = 50 V, V_{GS} = -8 V, F = 1 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°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 ($3*V_{DD}$ + abs(V_{GG})) <175 V.
5. Junction Temperature (T_J) = $T_C + \Theta_{JC} * ((V * I) - (P_{OUT} - P_{IN}))$

Typical transient thermal resistances:
1 ms pulse, 10% duty cycle, Θ_{JC} = 5.0°C/W
For T_C = 85°C,
T_J = 132°C @ 50 V, 520 mA-pk, P_{OUT} = 17.0 W, P_{IN} = 0.5 W

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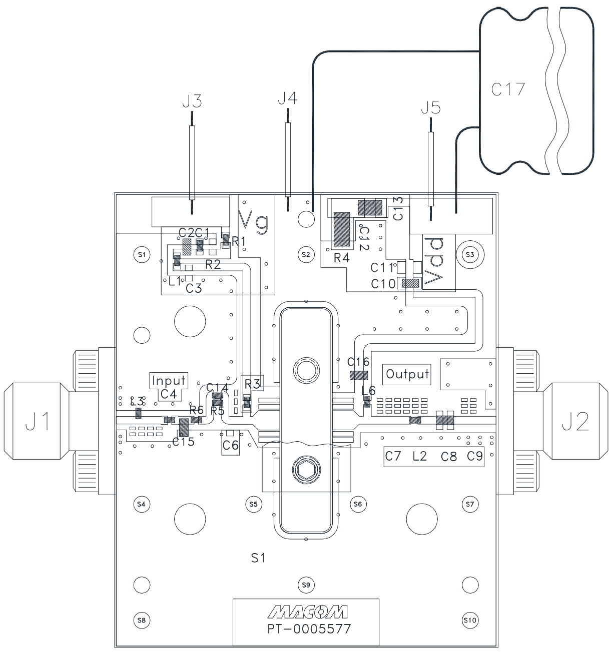
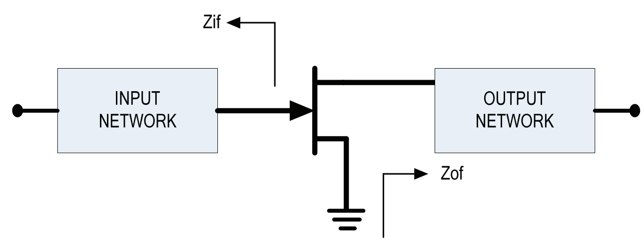
Test Fixture Assembly (1.2 - 1.4 GHz, 1 ms Pulse, 10% Duty, V_{DD} = 50 V, Idq = 15 mA)



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, ±10%	ATC
C16	0603, 100 pF, ±10%	ATC
C1, C10	0402, 1000 pF, 100 V, 5%	ATC
C8	0603, 30 pF, ±10%	ATC
C13	0805, 1 µF, 100 V, ±20%	ATC
C14	0402, 12 pF, ±10%	ATC
C17	100 µF, 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

Contact factory for Gerber file or additional circuit information.

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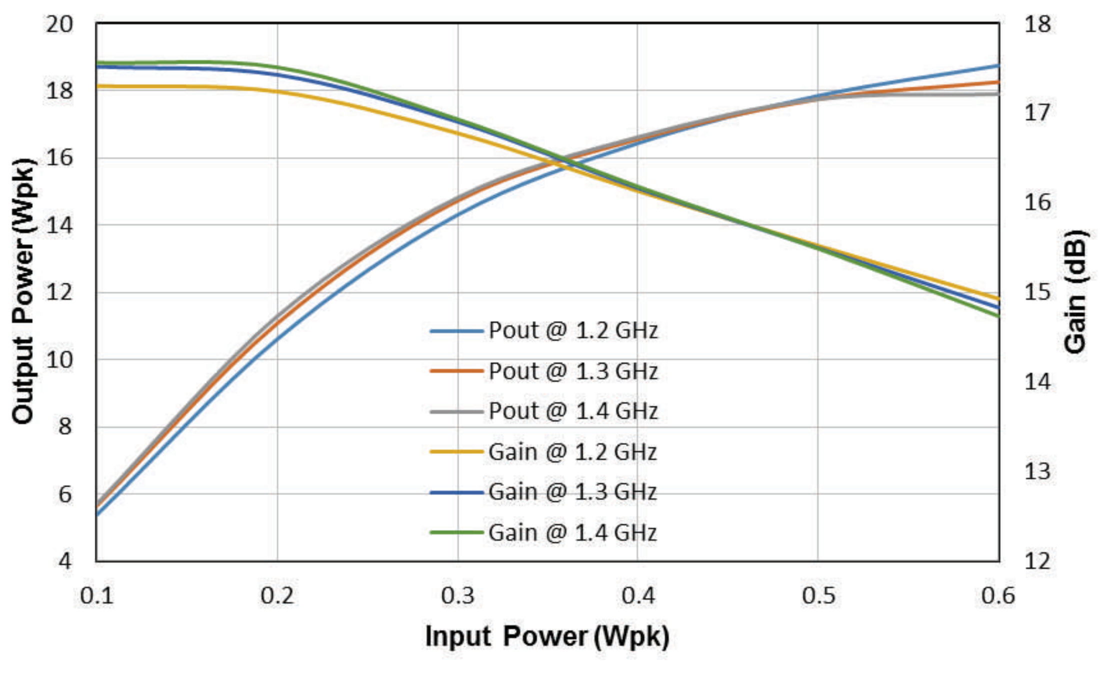
Application Section

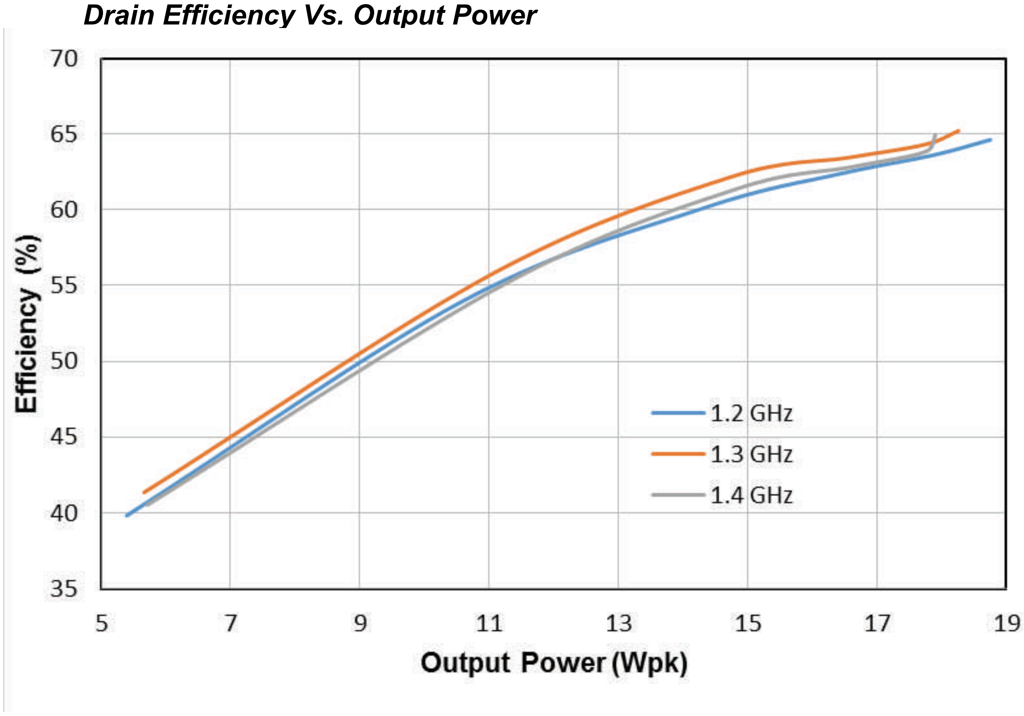
Typical Performance Curves

1.2 - 1.4 GHz, 1 ms Pulse, 10% Duty, V_{DD} = 50 V, Idq = 15 mA, T_A = 25°C

Output Power and Gain Vs. Input Power



Drain Efficiency Vs. Output Power



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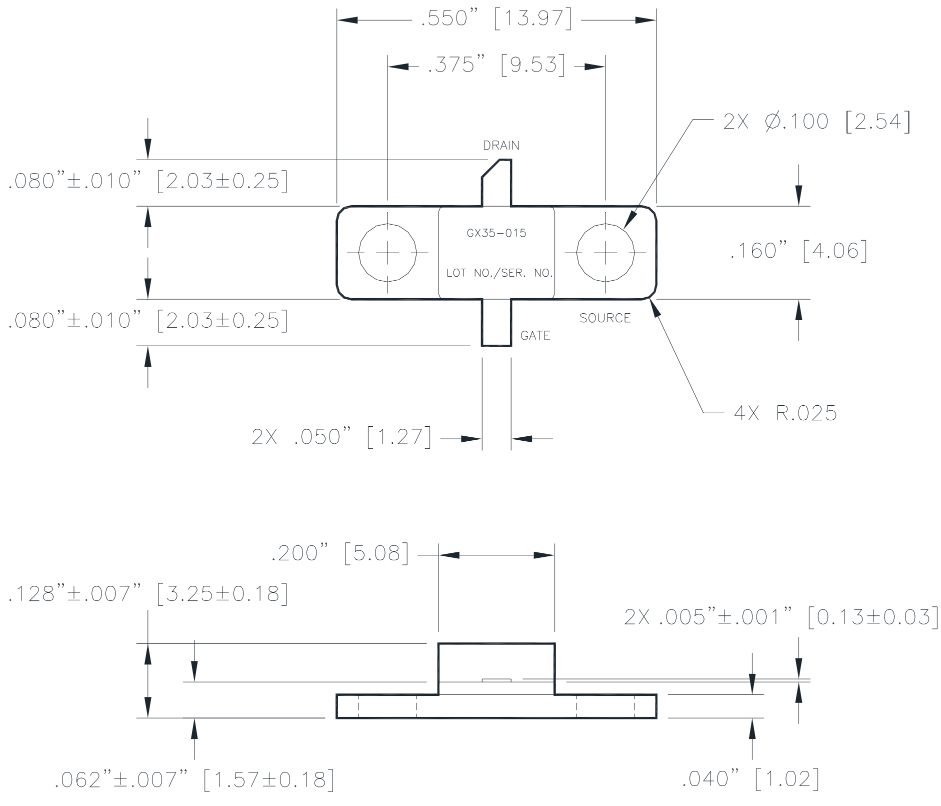
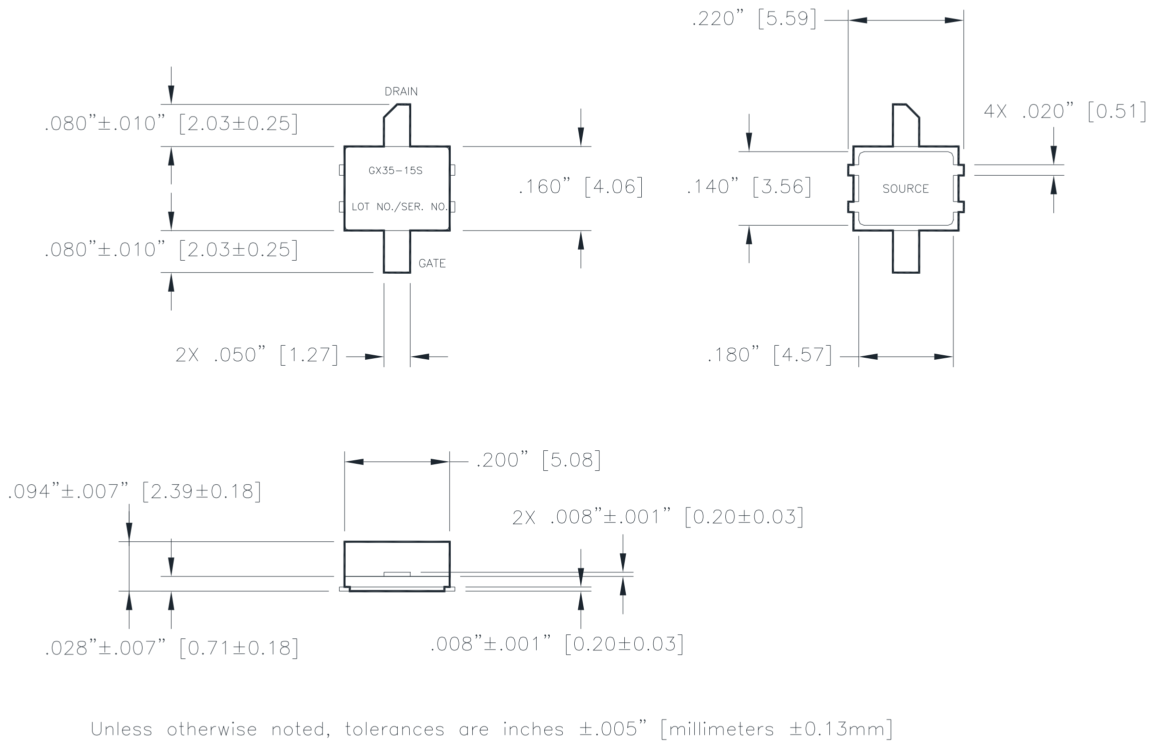
Outline Drawing MAGX-000035-015000 (Flanged)



Unless otherwise noted, tolerances are inches ±.005" [millimeters ±0.13mm]

Outline Drawing MAGX-000035-01500S (Flangeless)



LEAD TRIMMING INSTRUCTIONS
N/A

MARKING INSTRUCTIONS
LOT NO./SER NO. is LLLLLSSS Where LLLLL = last 5 digits of lot and SSS = last 3 digits of serial number.