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MAGX-001214-500L00

MAGX-001214-500L0S

GaN on SiC HEMT Pulsed Power Transistor
500 W Peak, 1200-1400 MHz, 300 μ s Pulse, 10% Duty

Rev. V2

Features

- GaN on SiC D-Mode Transistor Technology
- Internally Matched
- Common-Source Configuration
- Broadband Class AB Operation
- RoHS* Compliant and 260°C Reflow Compatible
- +50 V Typical Operation
- MTTF = 600 years ($T_J < 200^\circ\text{C}$)

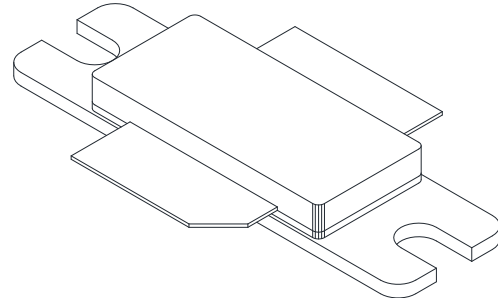
Applications

- L-Band pulsed radar

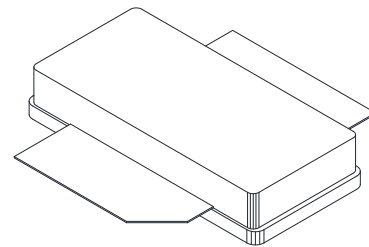
Description

The MAGX-001214-500L00 is a gold-metalized matched Gallium Nitride (GaN) on Silicon Carbide (SiC) RF power transistor optimized for pulsed L-Band radar applications. Using state of the art wafer fabrication processes, these high performance transistors provide high gain, efficiency, bandwidth, and ruggedness over a wide bandwidth for today's demanding application needs. High breakdown voltages allow for reliable and stable operation under more extreme mismatch load conditions compared with older semiconductor technologies.

MAGX-001214-500L00



MAGX-001214-500L0S



Ordering Information

Part Number	Description
MAGX-001214-500L00	Flanged
MAGX-001214-500L0S	Flangeless
MAGX-001214-SB3PPR	1.2 - 1.4 GHz Evaluation Board

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

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Typical RF Performance under standard operating conditions, $P_{OUT} = 500$ W (Peak)

Freq. (MHz)	P_{IN} (W)	Gain (dB)	I_D (A)	Eff. (%)	RL (dB)	Droop (dB)	+1dB OD (W)
1200	5.15	19.86	17.7	56.2	-12.7	0.29	568
1250	5.35	19.69	16.7	59.5	-10.3	0.30	561
1300	5.69	19.43	17.2	57.9	-10.9	0.33	554
1350	5.86	19.31	17.9	55.7	-15.3	0.36	547
1400	5.85	19.22	18.1	54.8	-17.5	0.38	549

Electrical Specifications: Freq. = 1200 - 1400 MHz, $I_{DQ} = 400$ mA, $T_A = 25^\circ\text{C}$

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
RF Functional Tests: $V_{DD} = 50$ V; 300 μs / 10%						
Input Power	$P_{OUT} = 500$ W Peak (50 W avg.)	P_{IN}	-	6	8.9	Wpk
Power Gain	$P_{OUT} = 500$ W Peak (50 W avg.)	G_P	17.5	19.2	-	dB
Drain Efficiency	$P_{OUT} = 500$ W Peak (50 W avg.)	η_D	50	56	-	%
Pulse Droop	$P_{OUT} = 500$ W Peak (50 W avg.)	Droop	-	0.4	0.7	dB
Load Mismatch Stability	$P_{OUT} = 500$ W Peak (50 W avg.)	VSWR-S	-	3:1	-	-
Load Mismatch Tolerance	$P_{OUT} = 500$ W Peak (50 W avg.)	VSWR-T	-	5:1	-	-
Extended Pulse Width Conditions: $V_{DD} = 42$ V; 1.0 ms / 10%; (typical RF data)						
Input Power	$P_{OUT} = 375$ W Peak (37.5 W avg.)	P_{IN}	-	5.3	-	Wpk
Power Gain	$P_{OUT} = 375$ W Peak (37.5 W avg.)	G_P	-	18.5	-	dB
Drain Efficiency	$P_{OUT} = 375$ W Peak (37.5 W avg.)	η_D	-	55	-	%

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

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
DC Characteristics:						
Drain-Source Leakage Current	$V_{GS} = -8$ V, $V_{DS} = 175$ V	I_{DS}	-	1.0	30	mA
Gate Threshold Voltage	$V_{DS} = 5$ V, $I_D = 75$ mA	$V_{GS(TH)}$	-5	-3.1	-2	V
Forward Transconductance	$V_{DS} = 5$ V, $I_D = 17.5$ mA	G_M	12.5	19.2	-	S
Dynamic Characteristics:						
Input Capacitance	Not applicable - Input matched	C_{ISS}	N/A	N/A	N/A	pF
Output Capacitance	$V_{DS} = 50$ V, $V_{GS} = -8$ V, $F = 1$ MHz	C_{OSS}	-	55	-	pF
Reverse Transfer Capacitance	$V_{DS} = 50$ V, $V_{GS} = -8$ V, $F = 1$ MHz	C_{RSS}	-	5.5	-	pF

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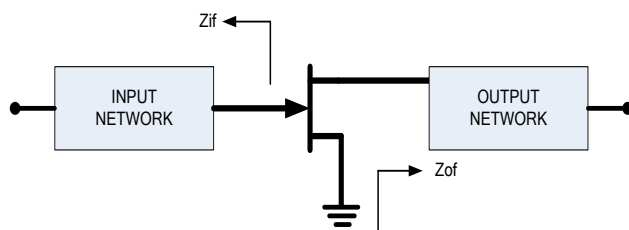
Absolute Maximum Ratings^{1,2,3,4}

Parameter	Limit
Supply Voltage (V_{DD})	+65 V
Supply Voltage (V_{GS})	-8 to -2 V
Supply Current ($I_{D_{MAX}}$)	21.5 A
Input Power (P_{IN})	P_{IN} (nominal) + 3 dB
Absolute Max. Junction/Channel Temp	200°C
Pulsed Power Dissipation at 85 °C	583 W
Thermal Resistance, ($T_J = 70$ °C) $V_{DD} = 50$ V, $I_{DQ} = 400$ mA, $P_{out} = 500$ W, 300 μ s Pulse / 10% Duty	0.30 °C/W
Operating Temp	-40 to +95°C
Storage Temp	-65 to +150°C
Mounting Temperature	See solder reflow profile
ESD Min. - Charged Device Model (CDM)	1300 V
ESD Min. - Human Body Model (HBM)	4000 V

1. Operation of this device above any one of these parameters may cause permanent damage.
2. Input Power Limit is +3 dB over nominal drive required to achieve $P_{OUT} = 500$ W.
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 recommended that the sum of $(3 \cdot V_{DD} + \text{abs}(V_{GS})) < 175$ V.

Test Fixture Impedances

F (MHz)	Z_{IF} (Ω)	Z_{OF} (Ω)
1200	1.2 - j1.2	1.8 + j0.5
1250	1.2 - j0.9	1.9 + j0.4
1300	1.3 - j0.6	2.0 + j0.3
1350	1.4 - j0.3	1.9 + j0.2
1400	1.6 + j0.0	1.7 + j0.1



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

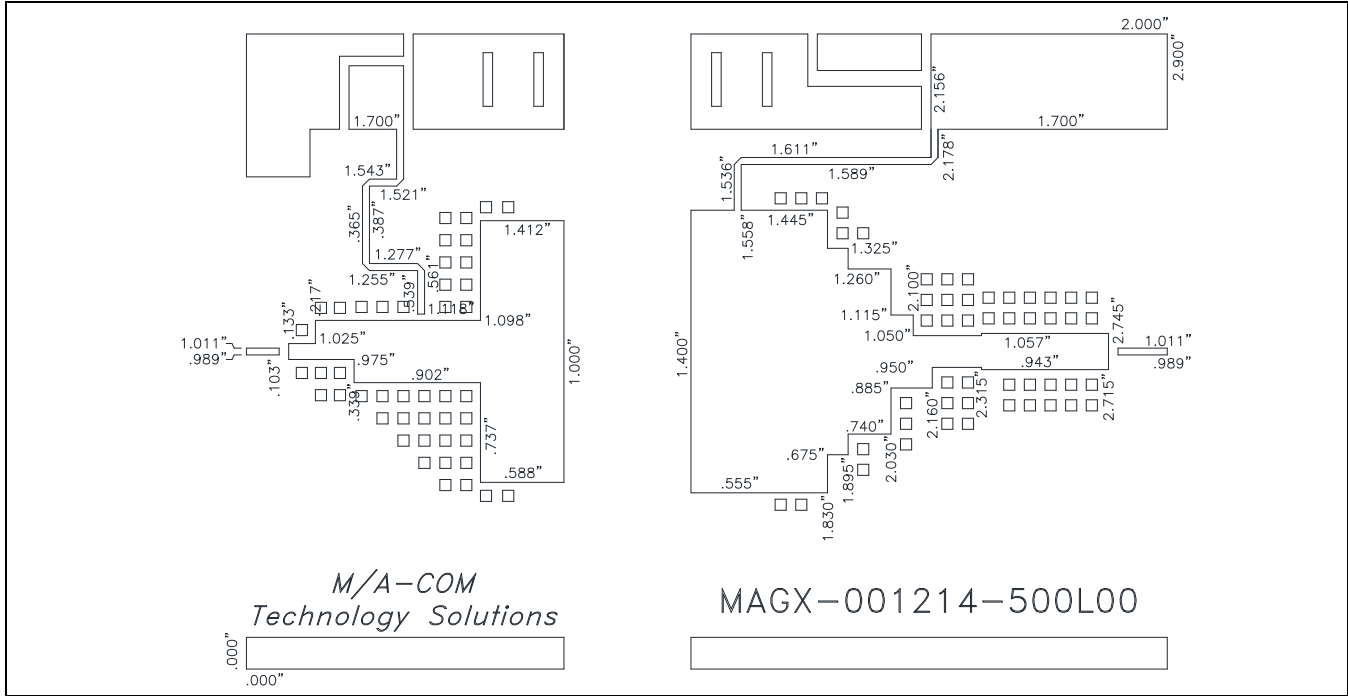
1. Turn the RF power off.
2. Decrease V_{GS} down to V_P .
3. Decrease V_{DS} down to 0 V.
4. Turn off V_{GS}

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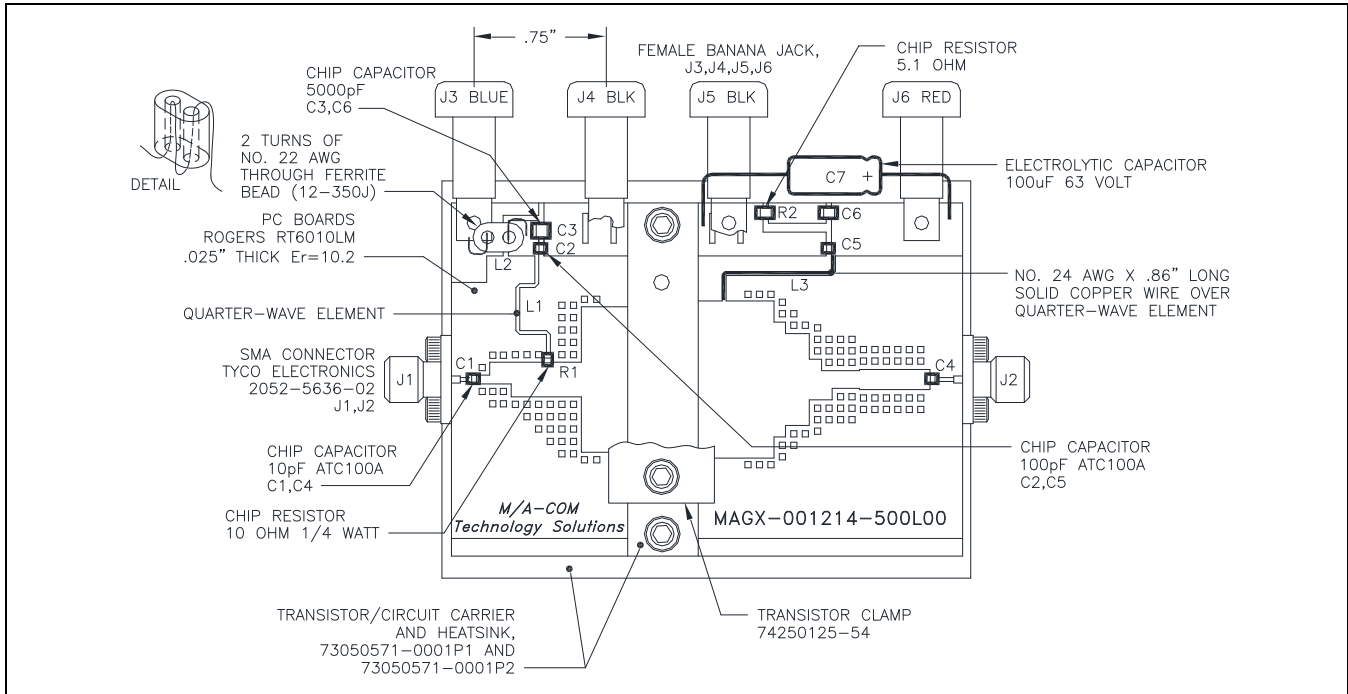
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Test Fixture Circuit Dimensions



Test Fixture Assembly



Contact factory for gerber file or additional circuit information.

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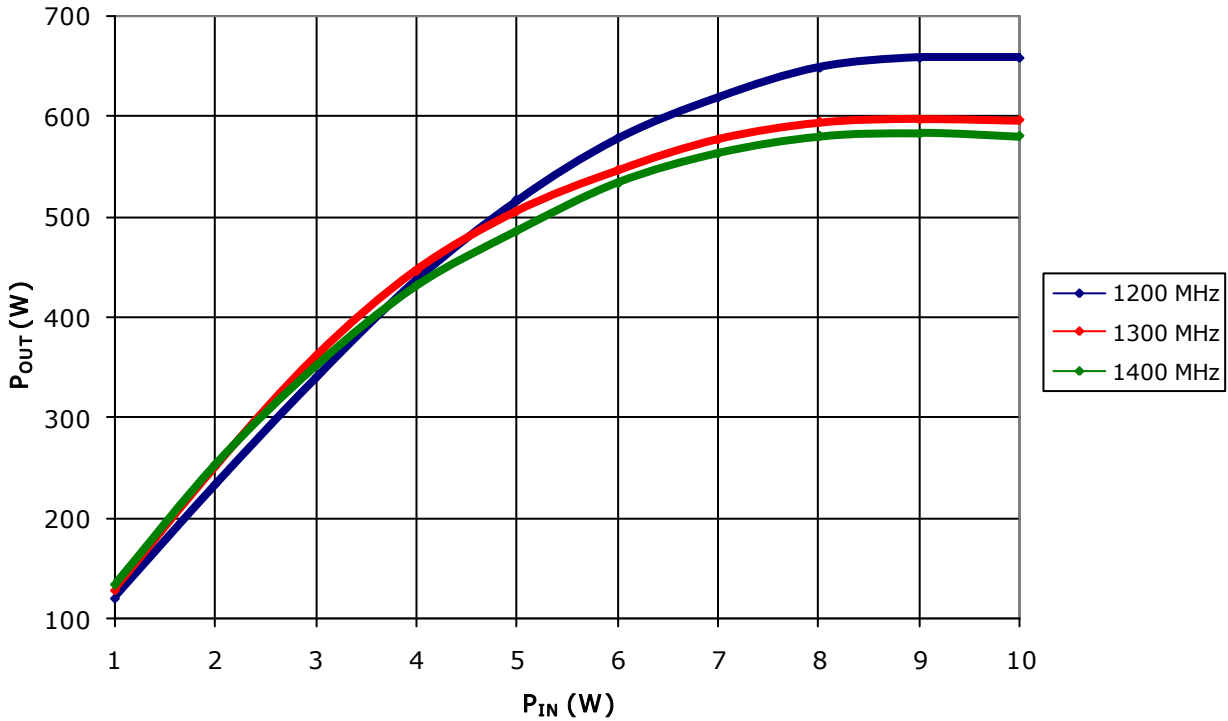
MAGX-001214-500L0S



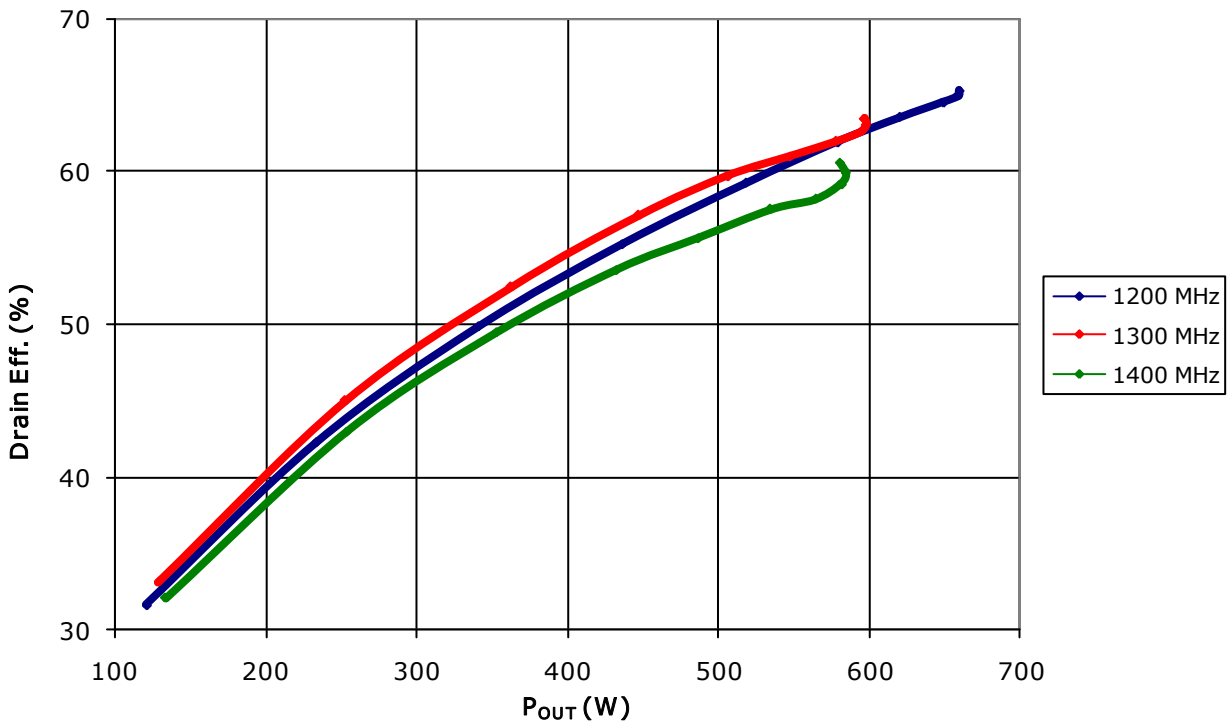
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RF Power Transfer Curve (Output Power Vs. Input Power)



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



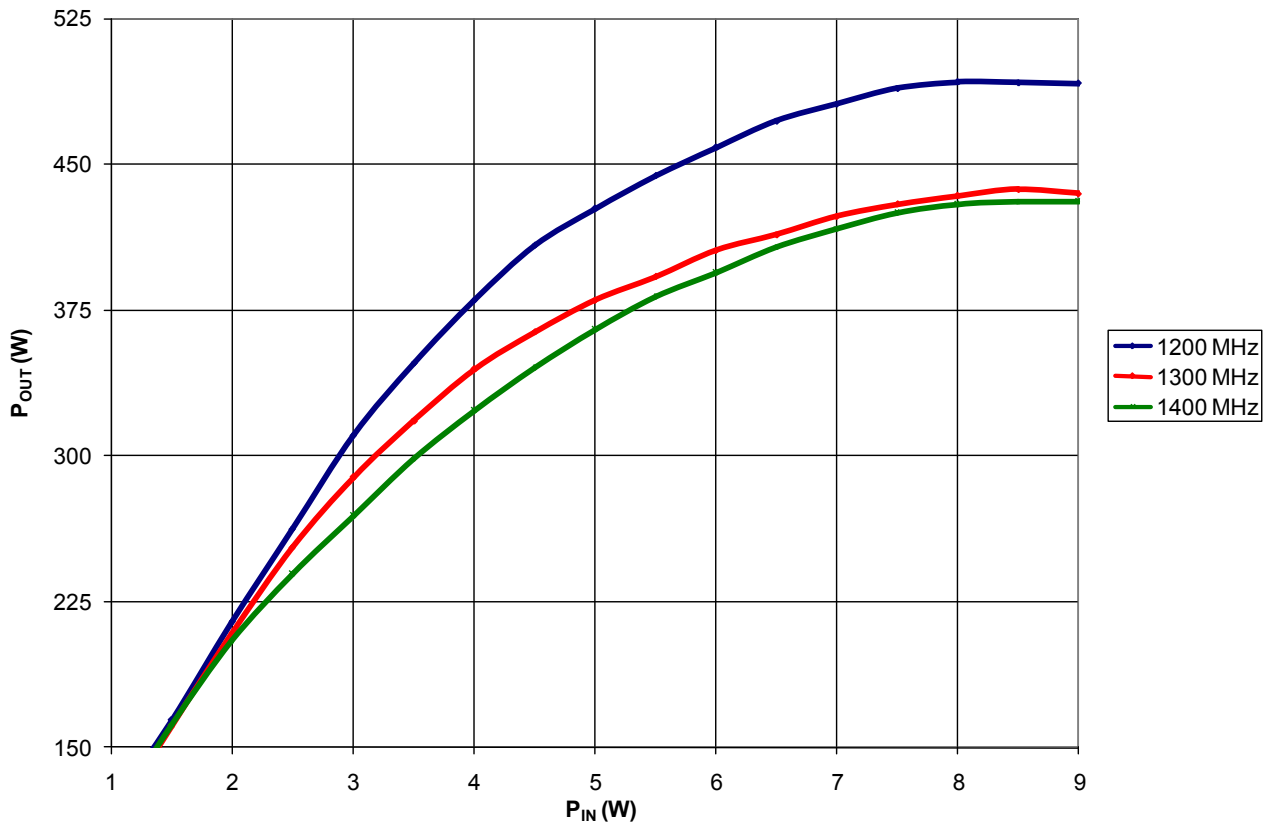
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Typical RF Data with 'extended pulse' conditions⁵:
1.0 ms Pulse, 10% Duty, $V_{DD} = 42$ V, $I_{DQ} = 400$ mA



5. Drain Voltage and RF output power is de-rated to keep junction temperature within acceptable levels.

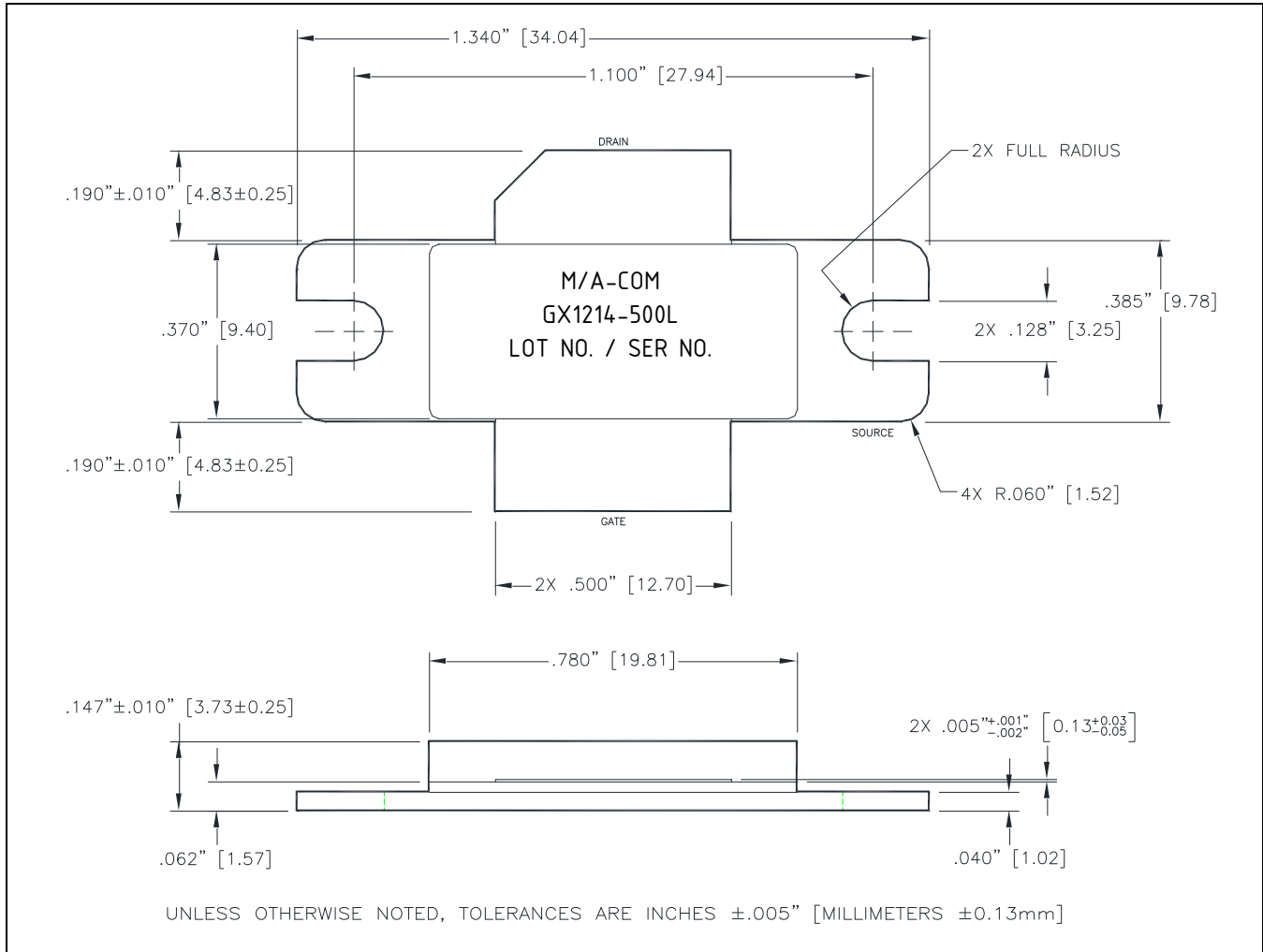
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Outline Drawing MAGX-002114-500L00



MAGX-001214-500L00

MAGX-001214-500L0S



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Outline Drawing MAGX-002114-500L0S

