

# MAGX-001214-500L00

# MAGX-001214-500L0S

**GaN on SiC HEMT Pulsed Power Transistor**  
**500 W Peak, 1200-1400 MHz, 300  $\mu$ 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 ( $T_J < 200^\circ\text{C}$ )

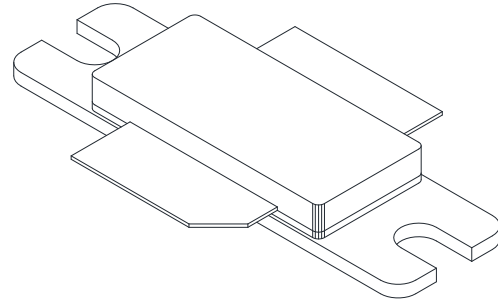
## Applications

- L-Band pulsed radar

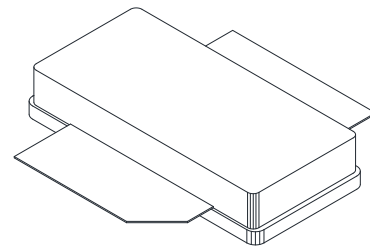
## Description

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.

# MAGX-001214-500L00

# MAGX-001214-500L0S



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

Rev. V2

**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
<b>RF Functional Tests: <math>V_{DD} = 50</math> V; 300 <math>\mu</math>s / 10%</b>						
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.)	$\eta_D$	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	-	-
<b>Extended Pulse Width Conditions: <math>V_{DD} = 42</math> V; 1.0 ms / 10%; (typical RF data)</b>						
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.)	$\eta_D$	-	55	-	%

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

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
<b>DC Characteristics:</b>						
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
<b>Dynamic Characteristics:</b>						
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

# MAGX-001214-500L00

# MAGX-001214-500L0S

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

Rev. V2

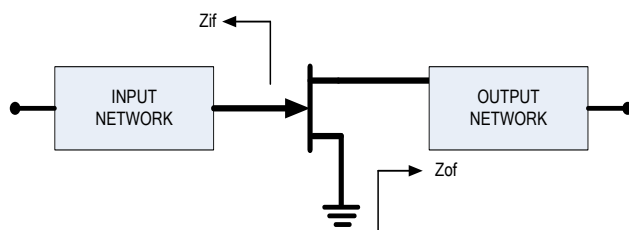
## Absolute Maximum Ratings<sup>1,2,3,4</sup>

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 $\mu$ 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)	$Z_{IF}$ ( $\Omega$ )	$Z_{OF}$ ( $\Omega$ )
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

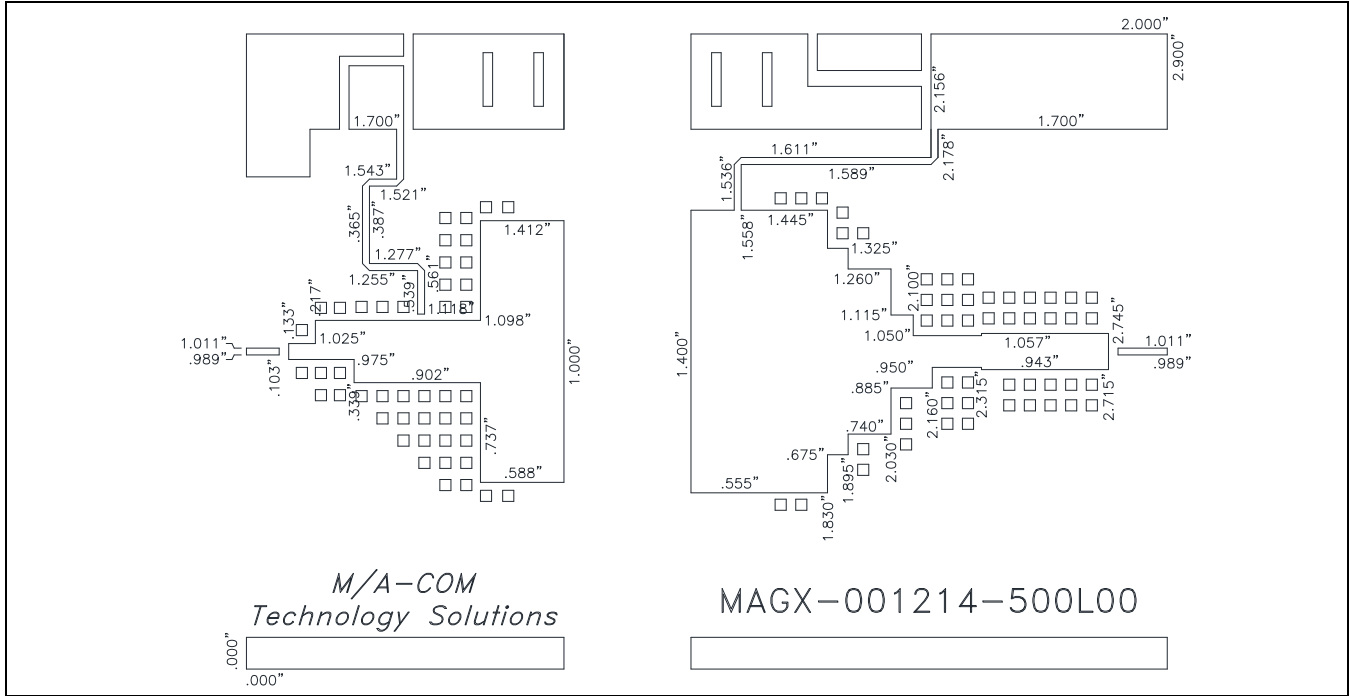
1. Turn the RF power off.
2. Decrease  $V_{GS}$  down to  $V_P$ .
3. Decrease  $V_{DS}$  down to 0 V.
4. Turn off  $V_{GS}$

# MAGX-001214-500L00 MAGX-001214-500L0S

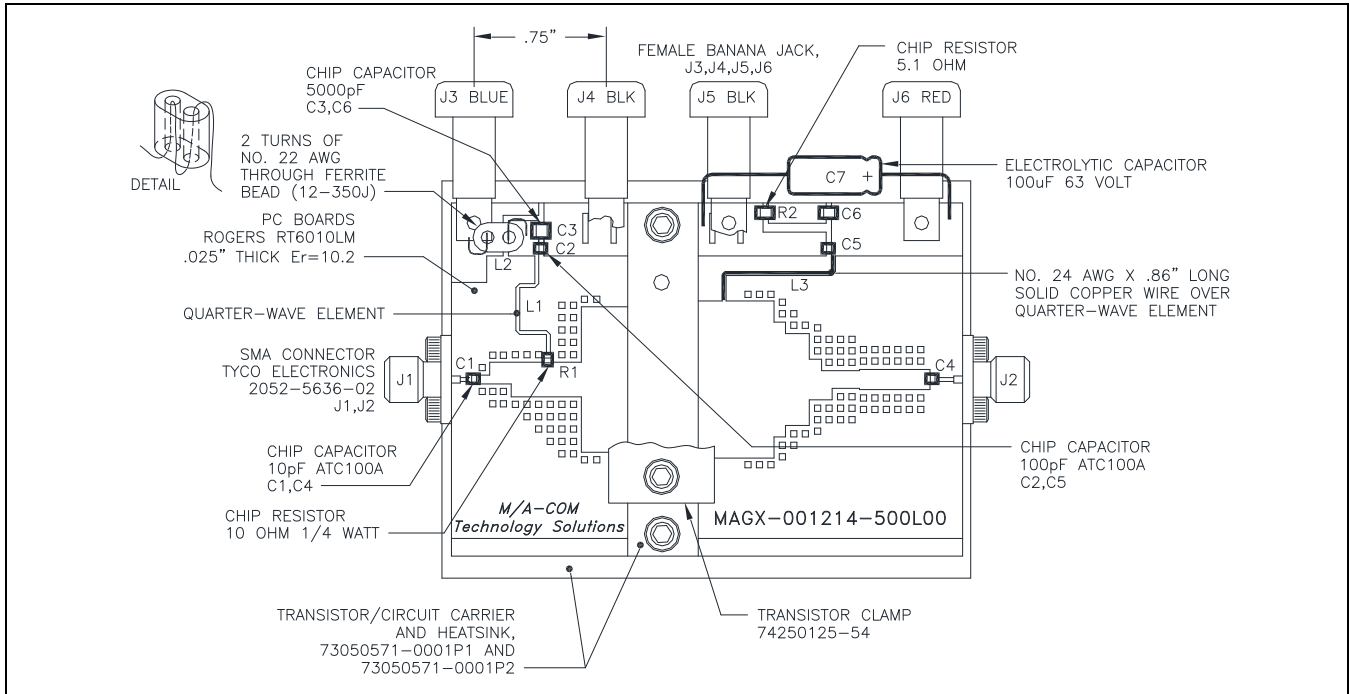
**GaN on SiC HEMT Pulsed Power Transistor**  
**500 W Peak, 1200-1400 MHz, 300  $\mu$ s Pulse, 10% Duty**

Rev. V2

## Test Fixture Circuit Dimensions



## Test Fixture Assembly



Contact factory for gerber file or additional circuit information.

# MAGX-001214-500L00

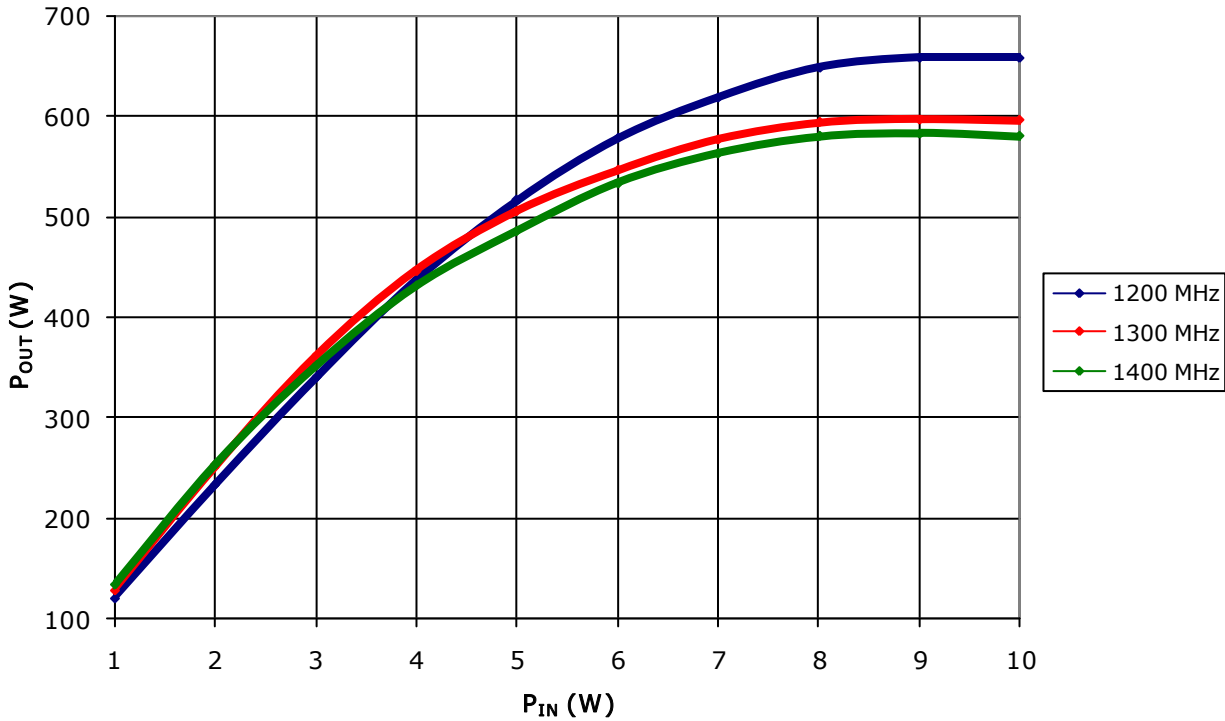
# MAGX-001214-500L0S



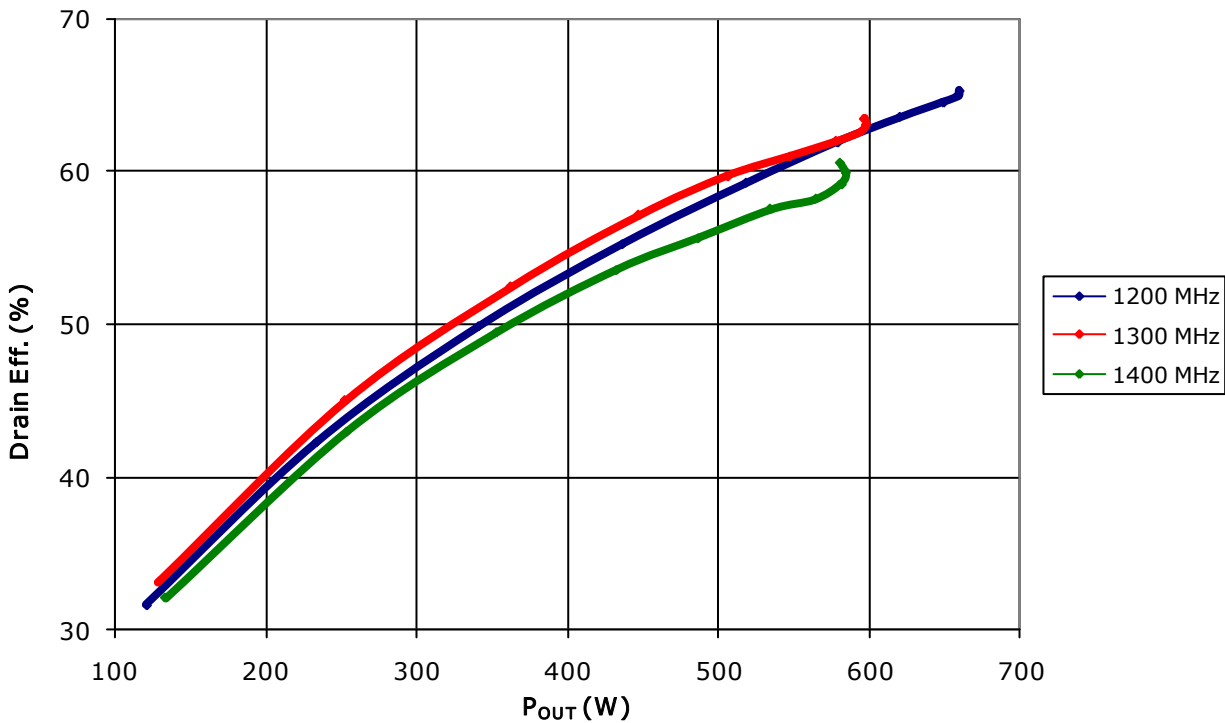
GaN on SiC HEMT Pulsed Power Transistor  
 500 W Peak, 1200-1400 MHz, 300  $\mu$ s Pulse, 10% Duty

Rev. V2

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



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



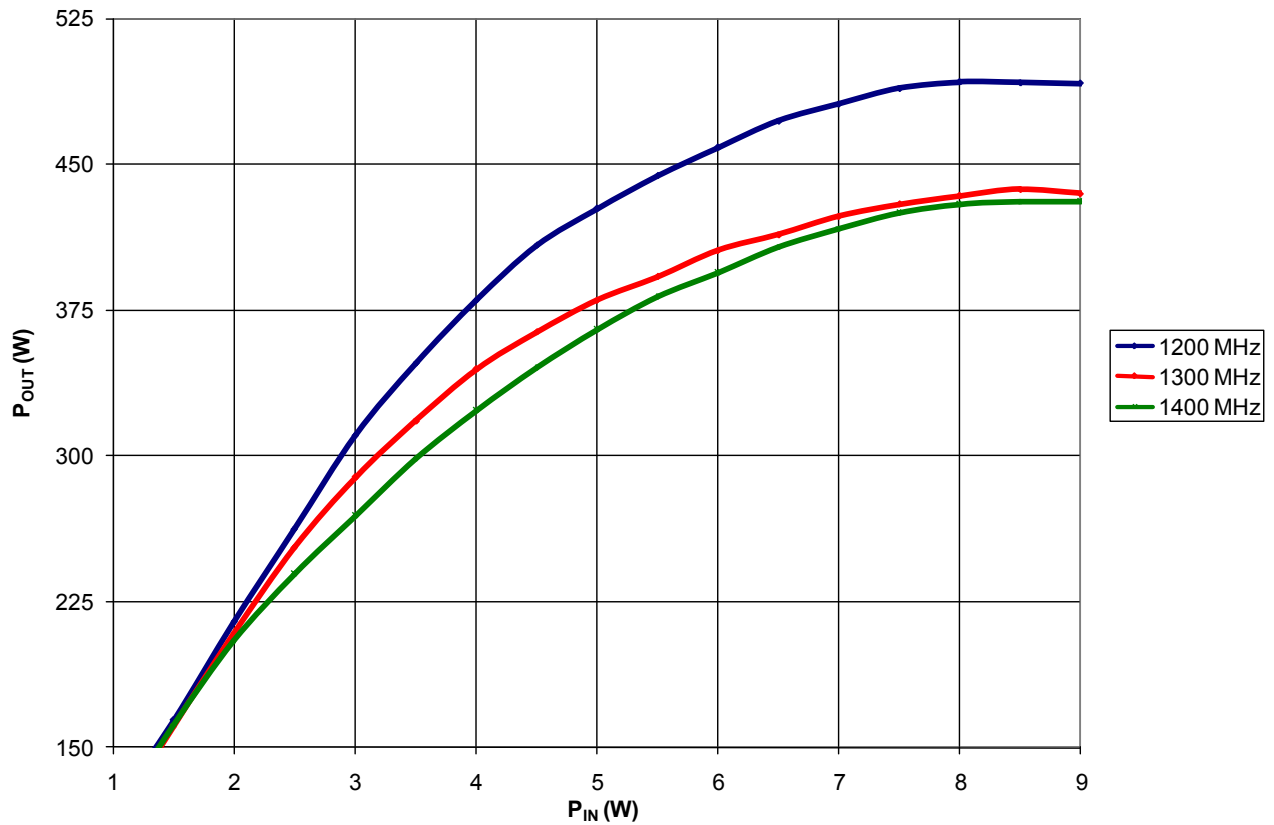
# MAGX-001214-500L00 MAGX-001214-500L0S



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

Rev. V2

Typical RF Data with 'extended pulse' conditions<sup>5</sup>:  
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.

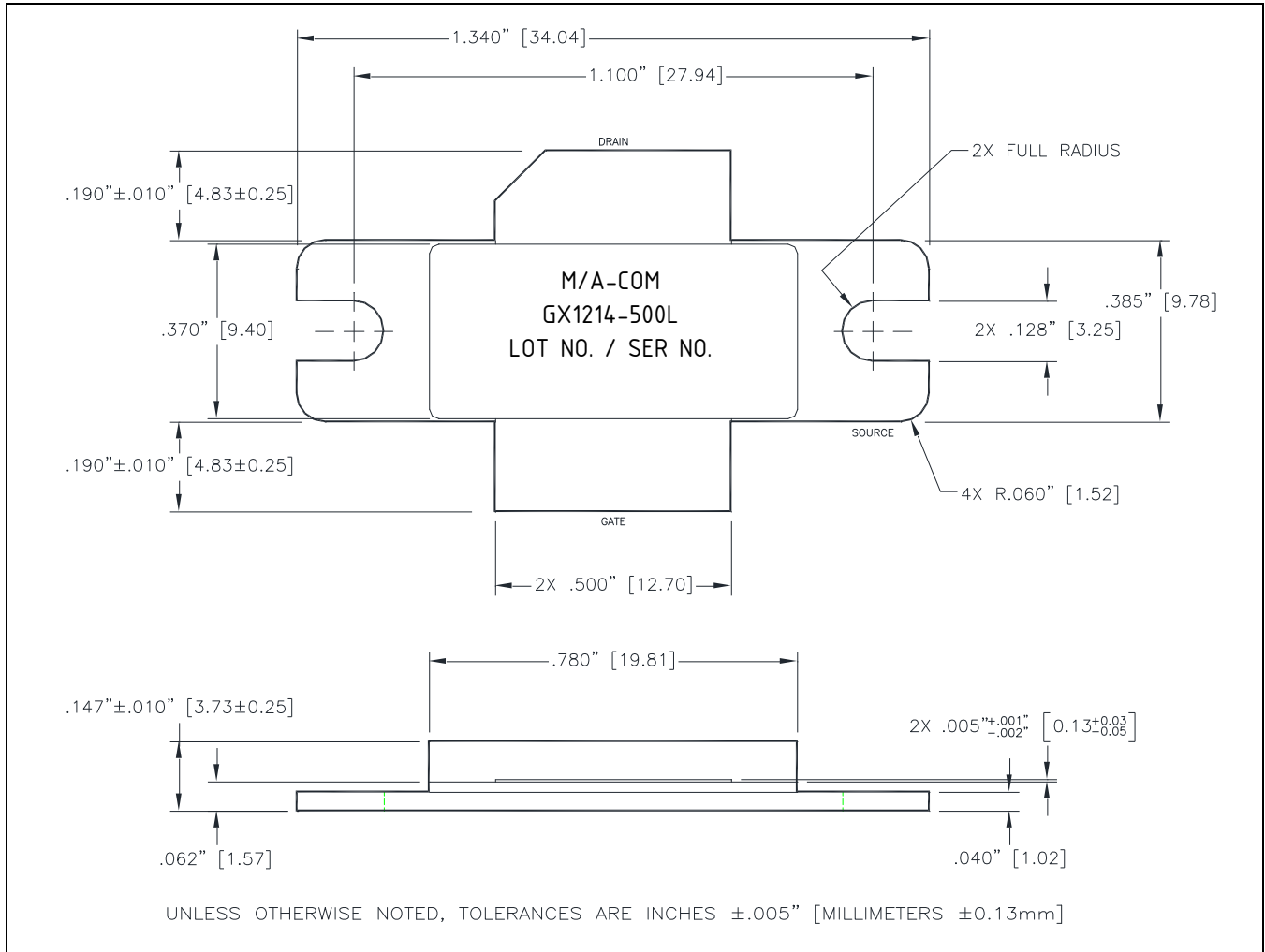
# MAGX-001214-500L00

## MAGX-001214-500L0S

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

Rev. V2

### Outline Drawing MAGX-002114-500L00



# MAGX-001214-500L00

# MAGX-001214-500L0S



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

Rev. V2

## Outline Drawing MAGX-002114-500L0S

