

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

Rev. V1

Features

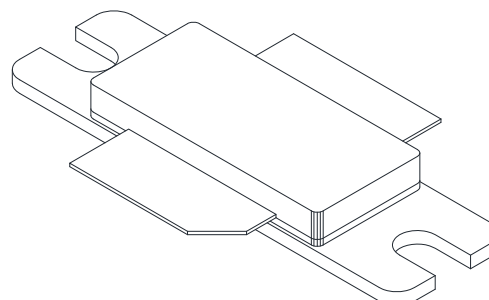
- GaN on SiC Depletion-Mode Transistor Technology
- Internally Matched
- Common-Source Configuration
- Broadband Class AB Operation
- RoHS* Compliant and 260 °C Reflow Compatible
- +50 V Typical Operation
- MTTF of 5.3×10^6 hours

Applications

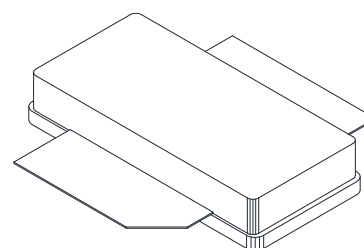
- L-Band pulsed radar

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

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

Ordering Information

Part Number	Description
MAGX-001214-500L00	500 W GaN Power Transistor (Flanged)
MAGX-001214-500L0S	500 W GaN Power Transistor (Flangeless)
MAGX-001214-SB3PPR	1.2 - 1.4 GHz Evaluation Board

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

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

Rev. V1

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_{DMAX})	21.5 A
Input Power (P_{IN})	P_{IN} (nominal) + 3 dB
Absolute Max. Junction/Channel Temp	200 °C
MTTF	600 years
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)	4000 V
ESD Min. - Human Body Model (HBM)	1300 V

1. Operation of this device above any one of these parameters may cause permanent damage.
2. Input Power Limit is +3dB 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 $(3 \cdot V_{DD} + \text{abs}(V_{GG})) < 175$ V.

DC Characteristics

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
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

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
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
Feedback Capacitance	$V_{DS} = 50$ V, $V_{GS} = -8$ V, $F = 1$ MHz	C_{RSS}	-	5.5	-	pF

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

Rev. V1

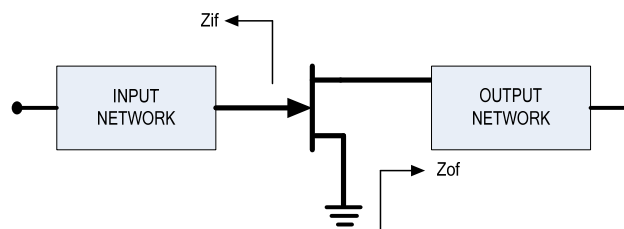
Electrical Specifications: $T_A = 25^\circ\text{C}$

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
RF FUNCTIONAL TESTS ($V_{DD} = 50\text{ V}$; $I_{DQ} = 400\text{ mA}$; 300 μs / 10%; 1200 - 1400 MHz)						
Input Power	$P_{OUT} = 500\text{ W Peak (50 W avg)}$	P_{IN}	-	6	8.9	Wpk
Power Gain	$P_{OUT} = 500\text{ W Peak (50 W avg)}$	G_P	17.5	19.2	-	dB
Drain Efficiency	$P_{OUT} = 500\text{ W Peak (50 W avg)}$	η_D	50	56	-	%
Pulse Droop	$P_{OUT} = 500\text{ W Peak (50 W avg)}$	Droop	-	0.4	0.7	dB
Load Mismatch Stability	$P_{OUT} = 500\text{ W Peak (50 W avg)}$	VSWR-S	-	3:1	-	-
Load Mismatch Tolerance	$P_{OUT} = 500\text{ W Peak (50 W avg)}$	VSWR-T	-	5:1	-	-

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
EXTENDED PULSE WIDTH CONDITIONS ($V_{DD} = 42\text{ V}$; $I_{DQ} = 400\text{ mA}$; 1.0 ms / 10%; 1200 - 1400 MHz) TYPICAL RF DATA						
Input Power	$P_{OUT} = 375\text{ W Peak (37.5 W avg)}$	P_{IN}	-	5.3	-	Wpk
Power Gain	$P_{OUT} = 375\text{ W Peak (37.5 W avg)}$	G_P	-	18.5	-	dB
Drain Efficiency	$P_{OUT} = 375\text{ W Peak (37.5 W avg)}$	η_D	-	55	-	%

Test Fixture Impedances

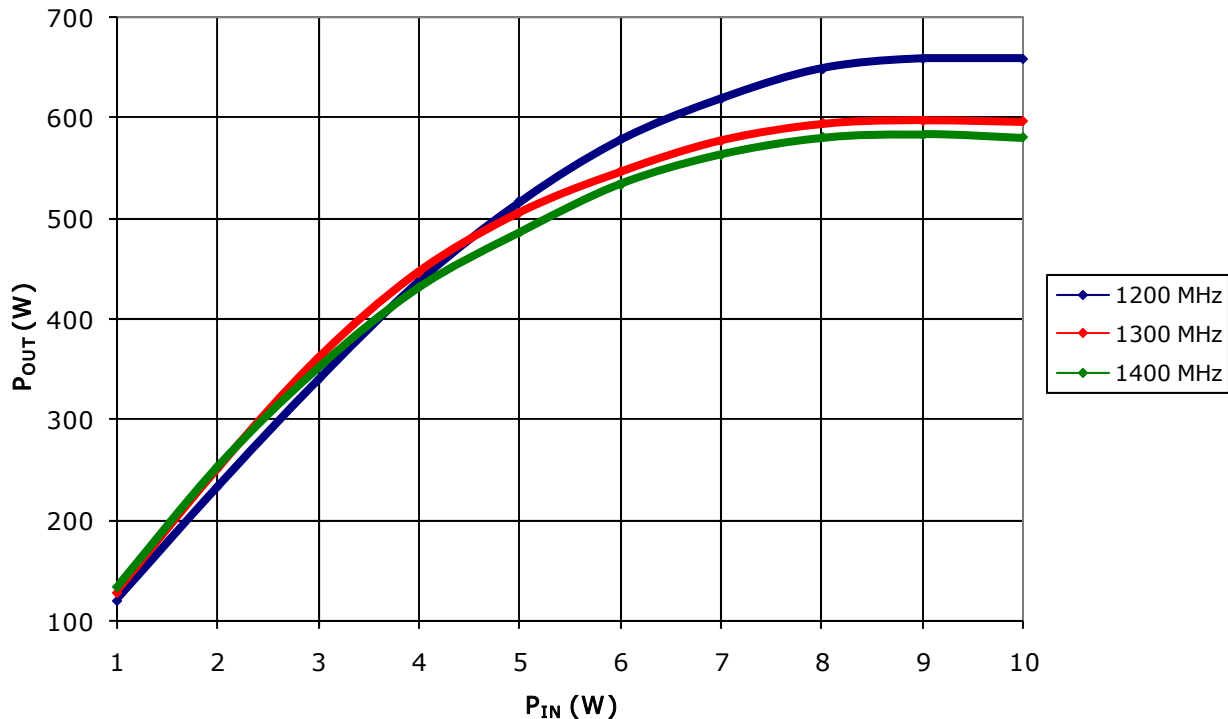
F (MHz)	$Z_{IF} (\Omega)$	$Z_{OF} (\Omega)$
1200	$1.2 - j1.2$	$1.8 + j0.5$
1250	$1.2 - j0.9$	$1.9 + j0.4$
1300	$1.3 - j0.6$	$2.0 + j0.3$
1350	$1.4 - j0.3$	$1.9 + j0.2$
1400	$1.6 + j0.0$	$1.7 + j0.1$



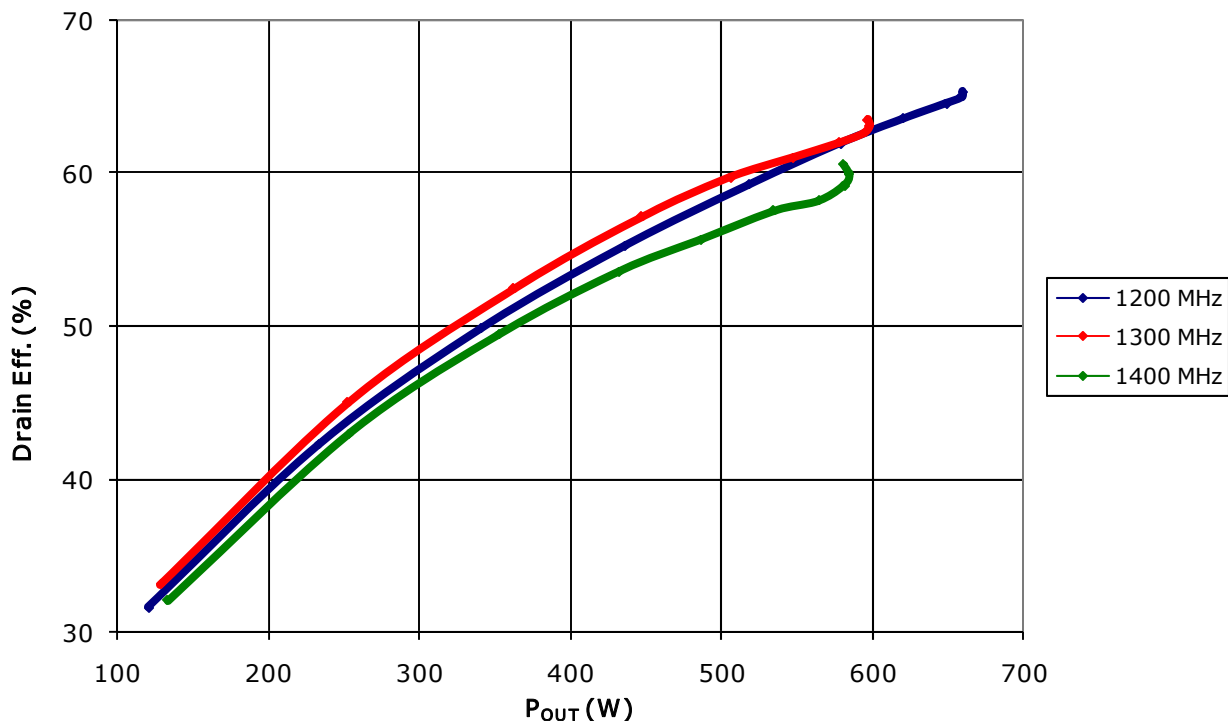
GaN on SiC HEMT Pulsed Power Transistor
500W Peak, 1200-1400 MHz, 300 μ s Pulse, 10% Duty

Rev. V1

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



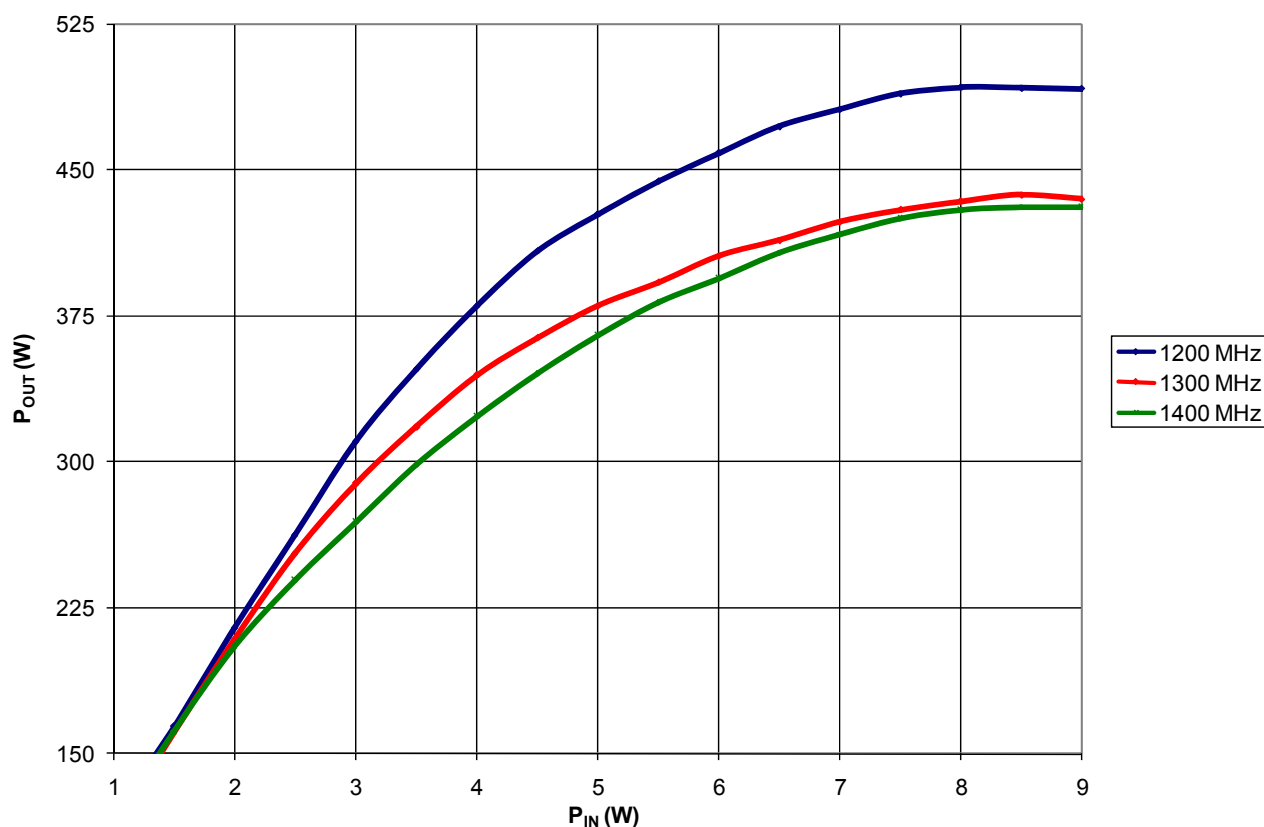
RF Power Transfer Curve (Drain Efficiency Vs. Output Power)



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

Rev. V1

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

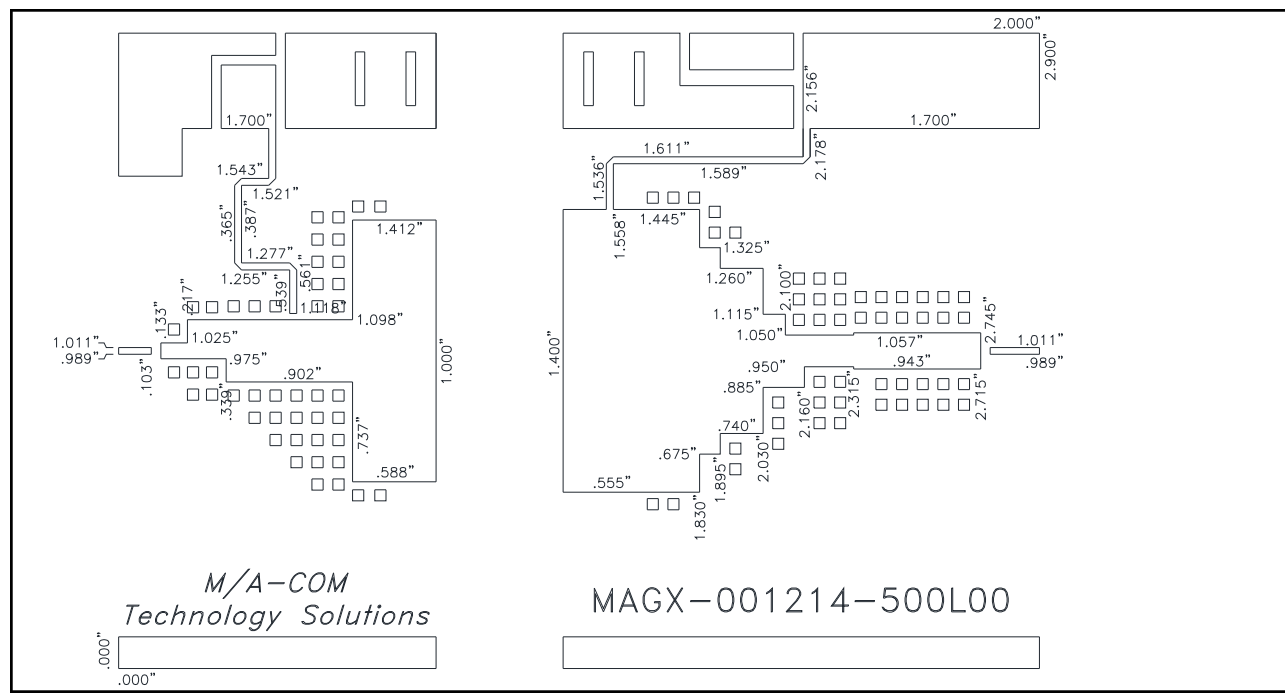


Note that Drain Voltage and RF output power is de-rated to keep junction temperature within acceptable levels.

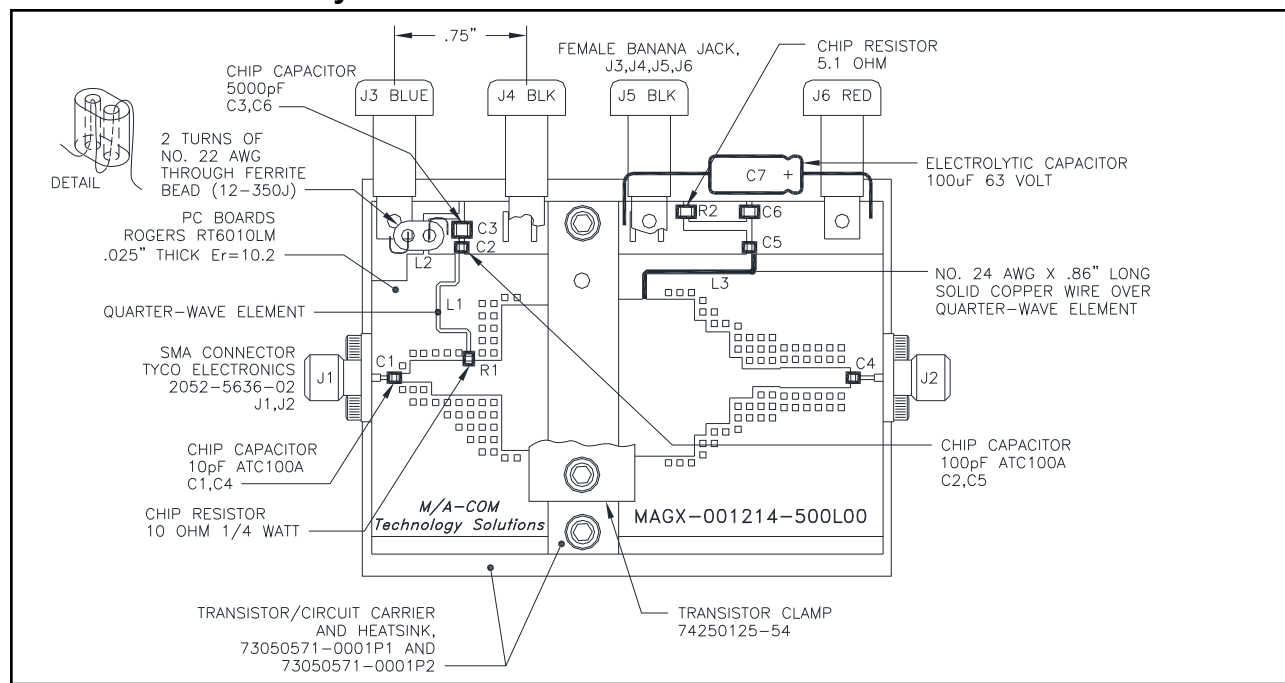
GaN on SiC HEMT Pulsed Power Transistor
500W Peak, 1200-1400 MHz, 300 μ s Pulse, 10% Duty

Rev. V1

Test Fixture Circuit Dimensions



Test Fixture Assembly

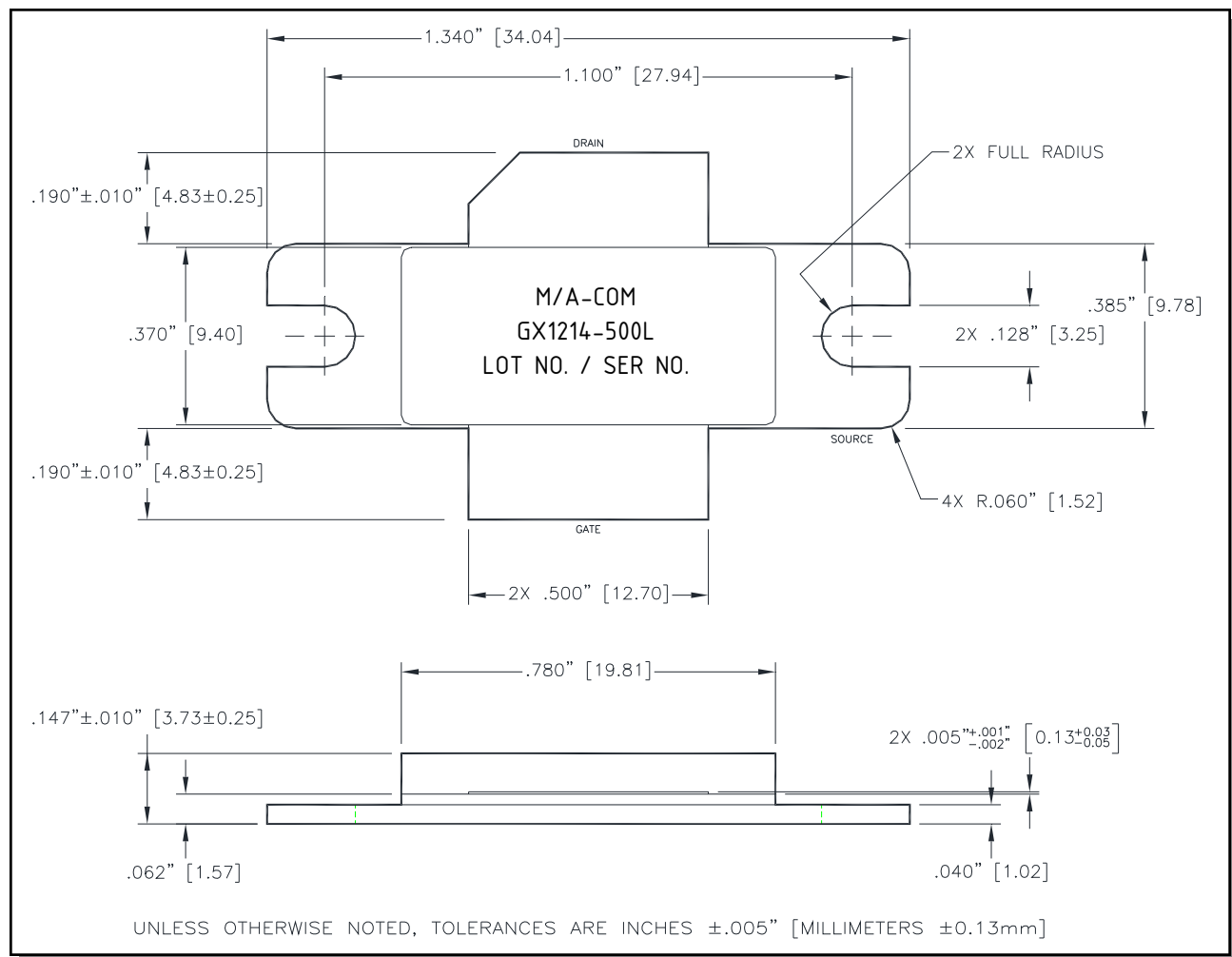


Contact factory for gerber file or additional circuit information.

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

Rev. V1

Outline Drawing MAGX-001214-500L00



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}

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

Rev. V1

Outline Drawing MAGX-001214-500L0S

