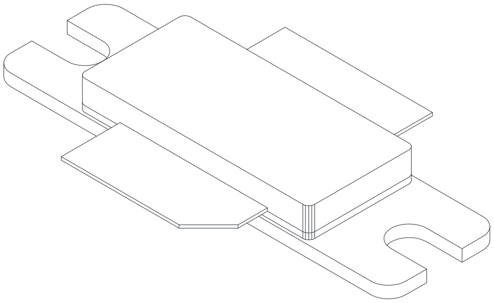
MAGX-001214-500L00
MAGX-001214-500L0S

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

Rev. V1

Features

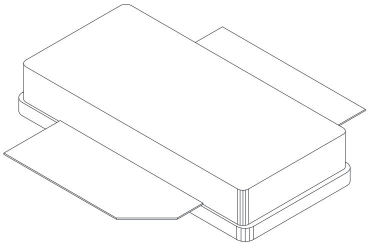
- GaN on SiC Depletion-Mode Transistor Technology
- Internally Matched
- Common-Source Configuration
- Broadband Class AB Operation
- RoHS* Compliant and 260 °C Reflow Compatible
- +50 V Typical Operation
- MTTF of 5.3 * 10^6 hours



MAGX-001214-500L00

Applications

- L-Band pulsed radar



MAGX-001214-500L0S

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.

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

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

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 ºC
MTTF	600 years
Pulsed Power Dissipation at 85 ºC	583 W
Thermal Resistance, (T_J= 70 ºC) V_{DD} = 50 V, I_{DQ} = 400 mA, Pout = 500 W, 300 µs Pulse / 10% Duty	0.30 ºC/W
Operating Temp	-40 to +95 ºC
Storage Temp	-65 to +150 ºC
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} = 500W.
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*V_{DD} + 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

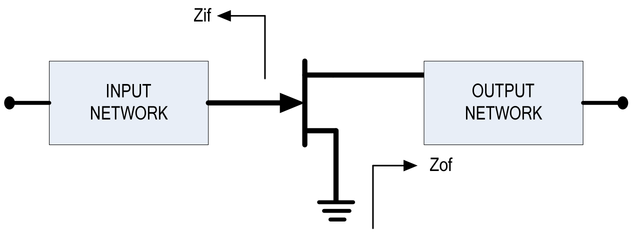
Electrical Specifications: T_A = 25 °C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
RF FUNCTIONAL TESTS (V_{DD} = 50 V; I_{DQ} = 400 mA; 300 µs / 10%; 1200 - 1400 MHz)						
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	-	-

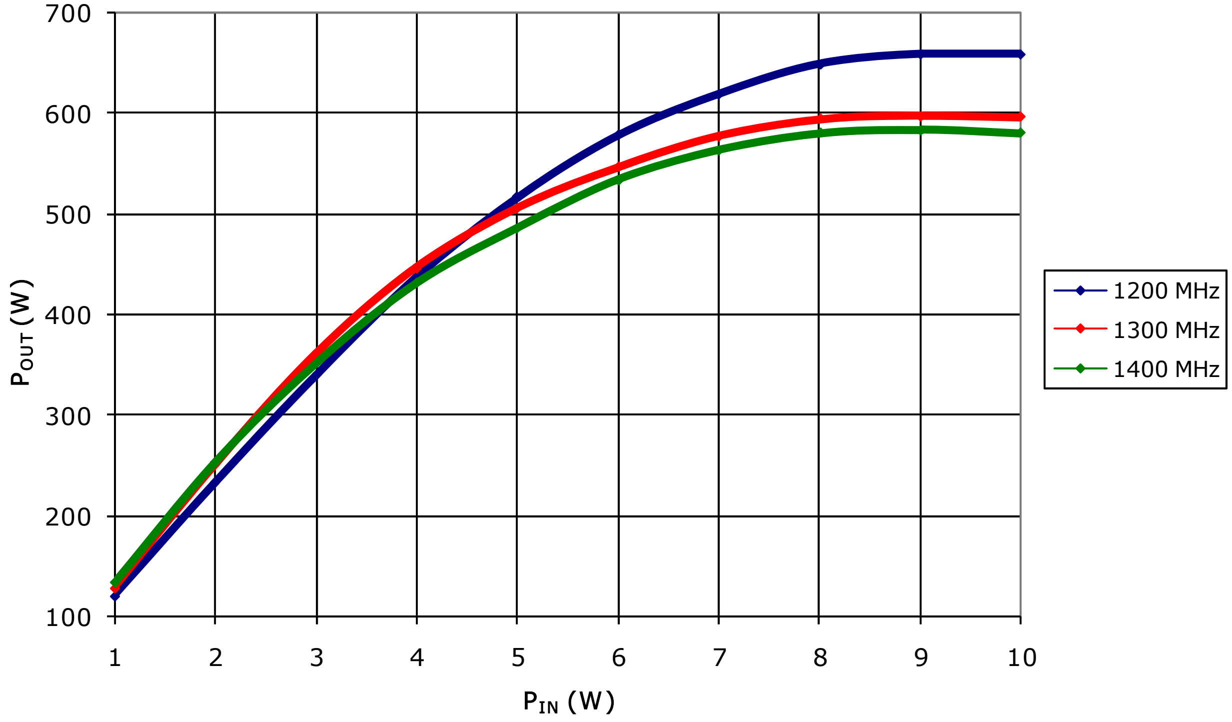
Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
EXTENDED PULSE WIDTH CONDITIONS (V_{DD} = 42 V; I_{DQ} = 400 mA; 1.0 ms / 10%; 1200 - 1400 MHz) TYPICAL RF DATA						
Input Power	P_{OUT}= 375 W Peak (37.5 W avg)	P_{IN}	-	5.3	-	Wpk
Power Gain	P_{OUT}= 375 W Peak (37.5 W avg)	G_P	-	18.5	-	dB
Drain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

Test Fixture Impedances

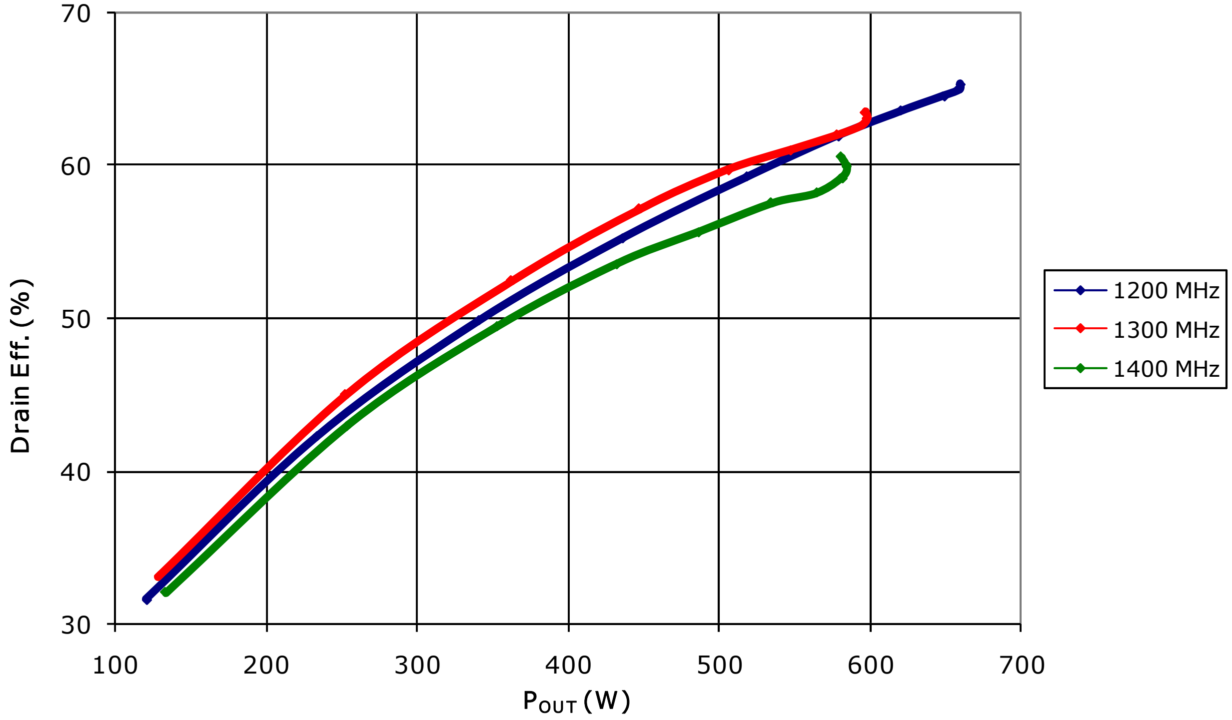
F (MHz)	Z_{IF} (Ω)	Z_{OF} (Ω)
1200	1.2 - j1.2	1.8 + j0.5
1250	1.2 - j0.9	1.9 + j0.4
1300	1.3 - j0.6	2.0 + j0.3
1350	1.4 - j0.3	1.9 + j0.2
1400	1.6 + j0.0	1.7 + j0.1



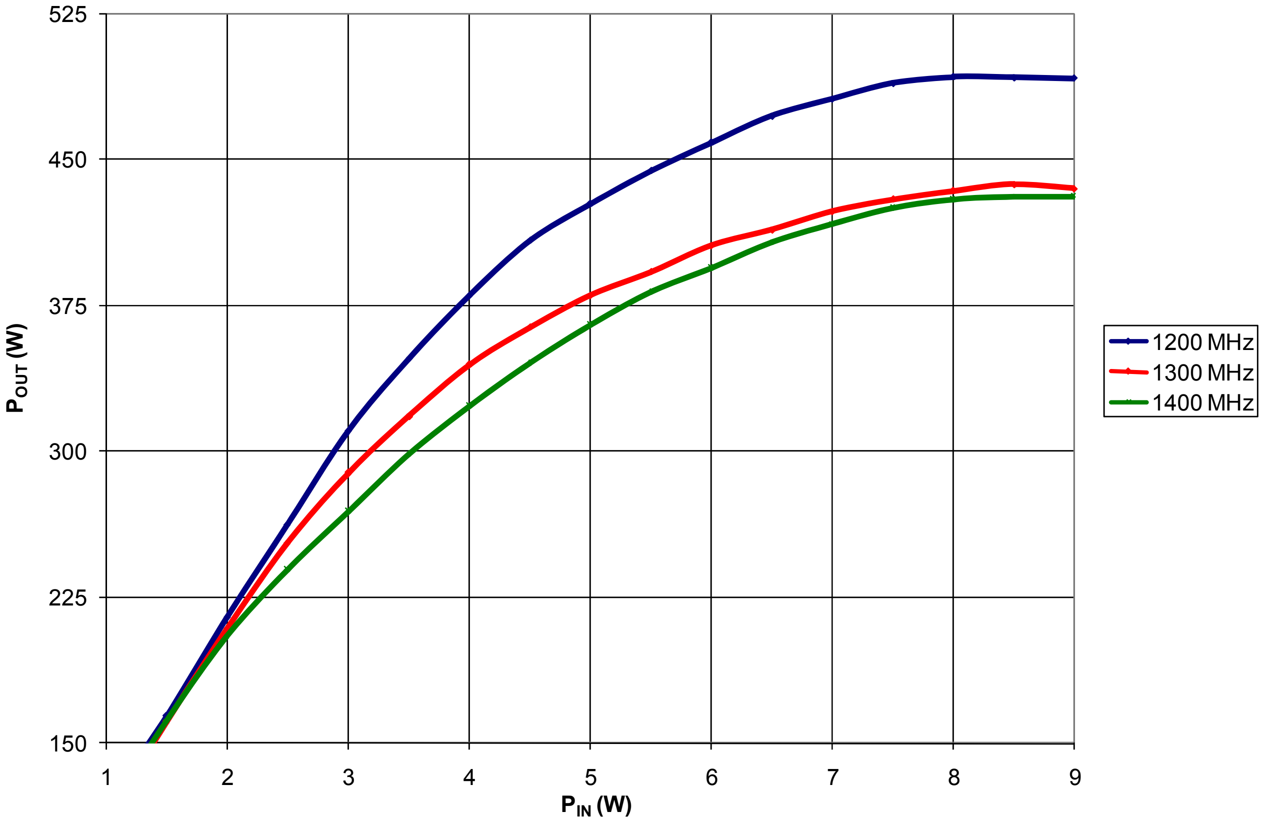
RF Power Transfer Curve (Output Power Vs. Input Power)



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

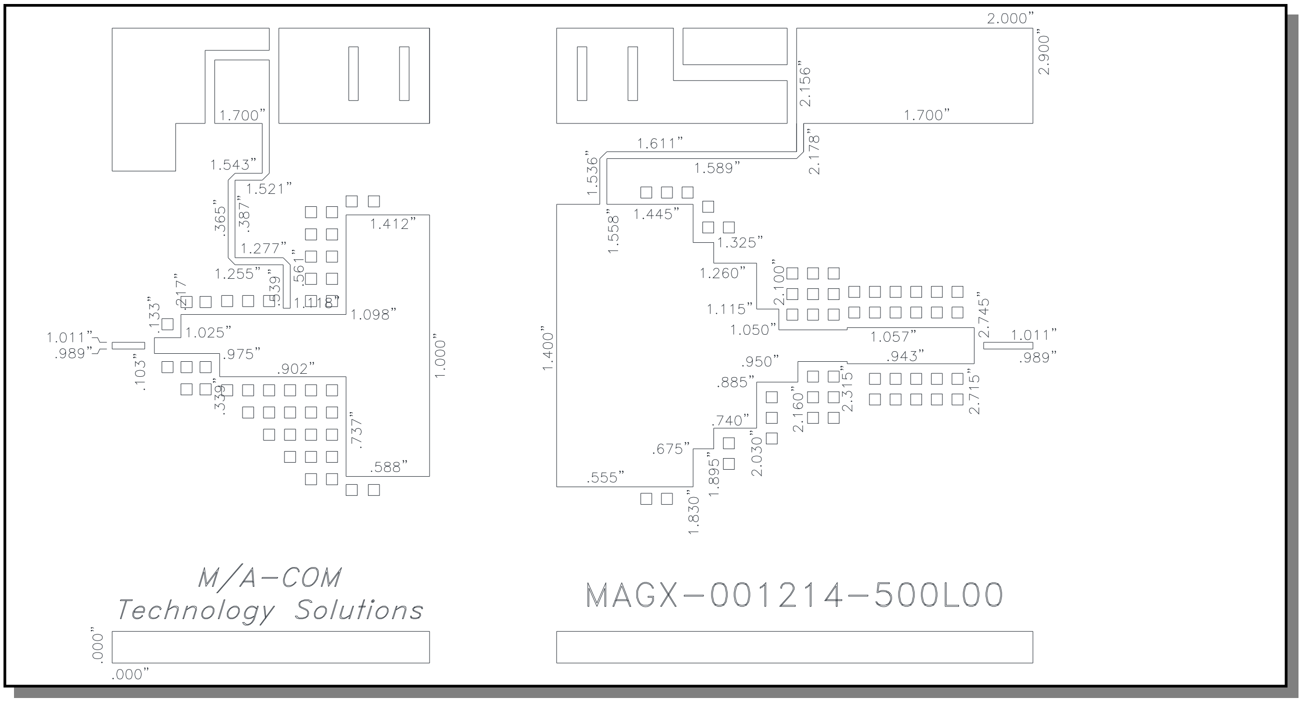


Typical RF Data with ‘extended pulse’ conditions: 1.0 ms Pulse, 10% Duty V_{DD} = 42 V, I_{DQ} = 400 mA

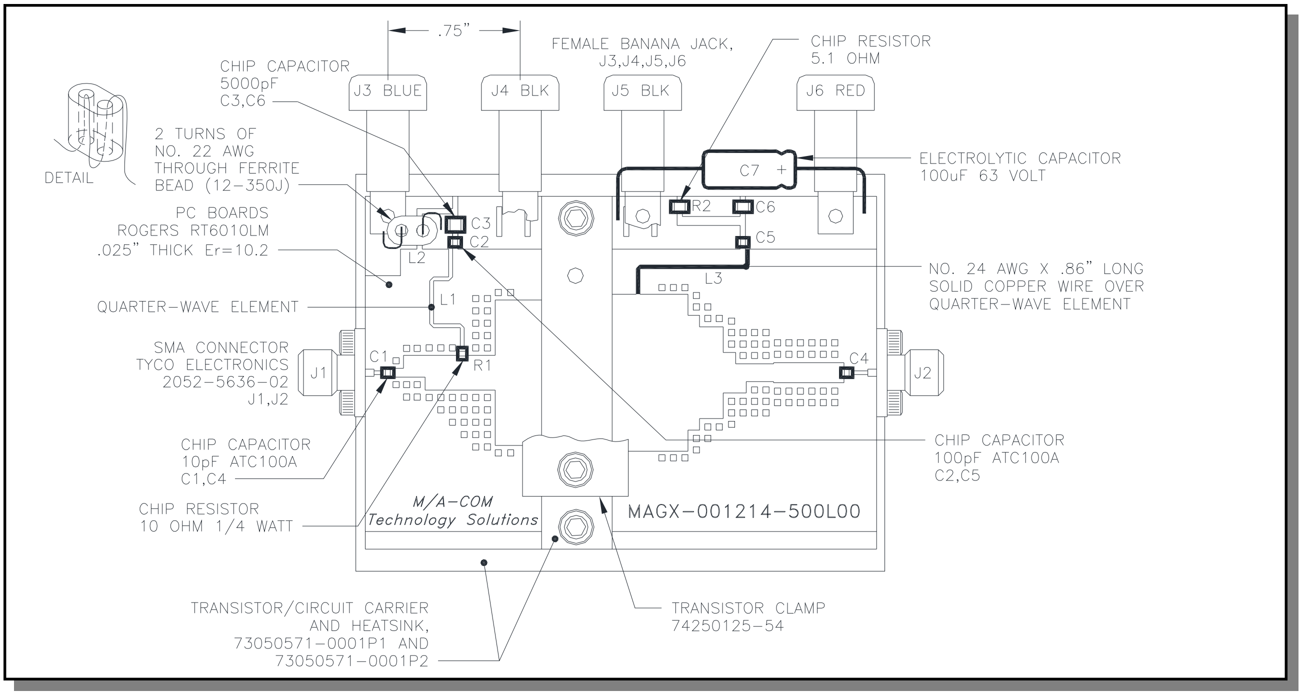


Note that Drain Voltage and RF output power is de-rated to keep junction temperature within acceptable levels.

Test Fixture Circuit Dimensions

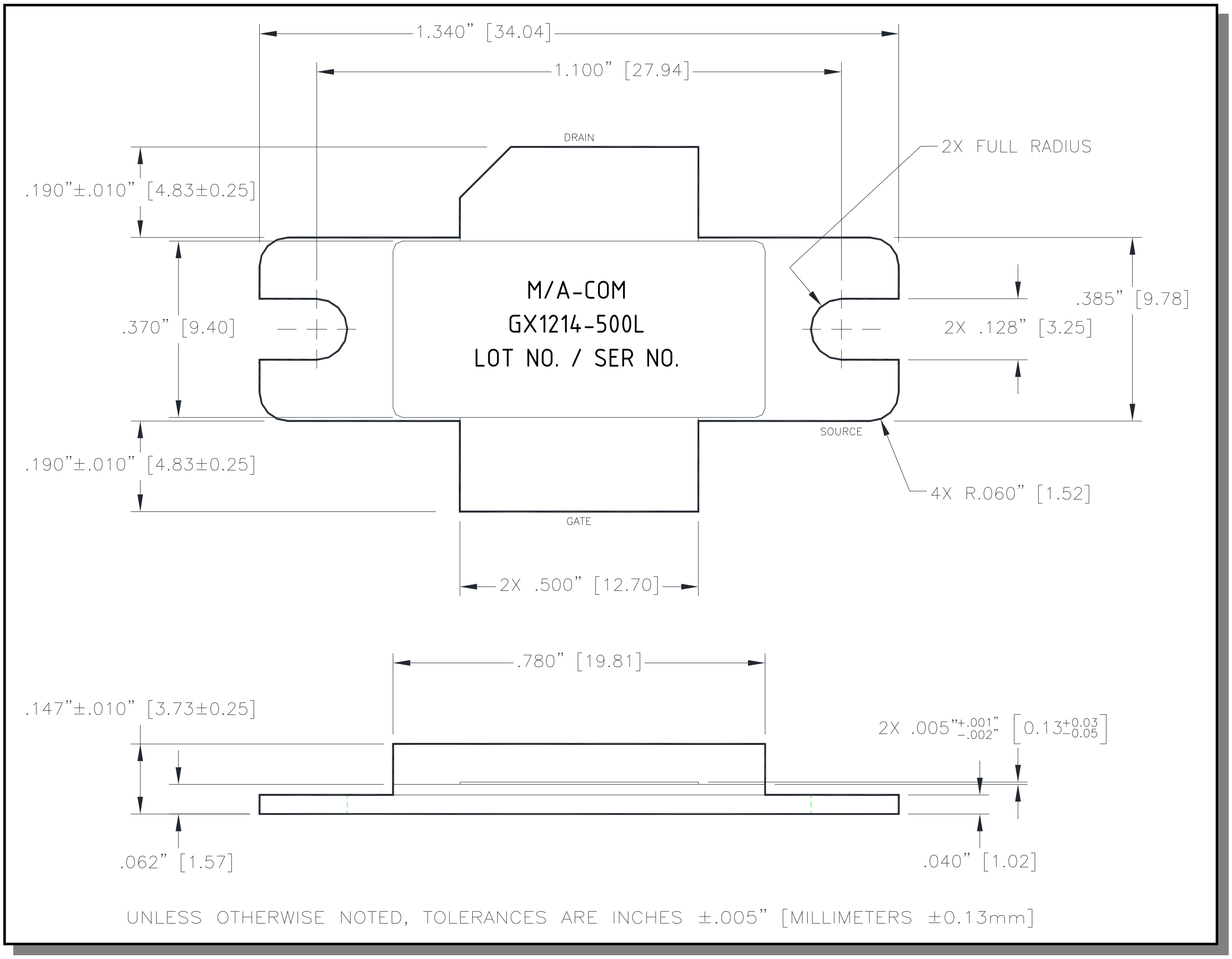


Test Fixture Assembly



Contact factory for gerber file or additional circuit information.

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}

Outline Drawing MAGX-001214-500L0S