MAGX-001090-600L00
MAGX-001090-600L0S

GaN on SiC HEMT Pulsed Power Transistor
600 W Peak, 1030 to 1090 MHz, 32 µs Pulse, 2% Duty

Rev. V3

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 = 600 years (T_J < 200°C)

Applications

- Civilian Air Traffic Control (ATC), L-Band secondary radar for IFF and Mode-S avionics.
- Military radar for IFF and Data Links.

Description

The MAGX-001090-600L00 is a gold metalized matched Gallium Nitride (GaN) on Silicon Carbide (SiC) RF power transistor optimized for pulsed avionics and 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-001090-600L00

MAGX-001090-600L0S

Ordering Information

Part Number	Description
MAGX-001090-600L00	Flanged
MAGX-001090-600L0S	Flangeless
MAGX-001090-SB0PPR	1.03 - 1.09 GHz Evaluation Board

* 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

GaN on SiC HEMT Pulsed Power Transistor
600 W Peak, 1030 to 1090 MHz, 32 µs Pulse, 2% Duty

Typical RF Performance under standard operating conditions, P_{OUT} = 600 W (Peak)

Freq (MHz)	P_{IN} (W)	Gain (dB)	I_D (A)	Eff. (%)	RL (dB)	Droop (dB)	+1dB OD (W)	VSWR-S (3:1)	VSWR-T (5:1)
1030	4.95	20.8	20.4	58.6	-16.8	0.24	649	S	P
1090	4.50	21.3	18.6	64.4	-11.0	0.23	661	S	P

Electrical Specifications: Freq. = 1030 - 1090 MHz, T_A = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
RF Functional Tests: **Standard Pulse Conditions: V_{DD} = 50 V, I_{DQ} = 600 mA; Pulse = 32 µs / 2%**						
Input Power	P_{OUT} = 600 W Peak (12 W avg.)	P_{IN}	-	4.3	6.7	Wpk
Power Gain	P_{OUT} = 600 W Peak (12 W avg.)	G_P	19.5	21.4	-	dB
Drain Efficiency	P_{OUT} = 600 W Peak (12 W avg.)	η_D	55	63	-	%
Pulse Droop	P_{OUT} = 600 W Peak (12 W avg.)	Droop	-	0.2	0.3	dB
Load Mismatch Stability	P_{OUT} = 600 W Peak (12 W avg.)	VSWR-S	-	3:1	-	-
Load Mismatch Tolerance	P_{OUT} = 600 W Peak (12 W avg.)	VSWR-T	-	5:1	-	-
Mode-S ELM Pulse Width Conditions[1]: V_{DD} = 50 V, I_{DQ} = 400 mA; **48 pulses of 32 µs on and 18 µs off, repeat every 24 ms; Overall Duty Factor = 6.4%**						
Input Power	P_{OUT} = 550 W Peak (35.2 W avg.)	P_{IN}	-	4.6	-	Wpk
Power Gain	P_{OUT} = 550 W Peak (35.2 W avg.)	G_P	-	20.7	-	dB
Drain Efficiency	P_{OUT} = 550 W Peak (35.2 W avg.)	η_D	-	61	-	%

1. For Mode-S ELM pulse conditions, RF power is measured at the middle of the 25th pulse in the burst (t ~ 1.216 ms)

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}	-	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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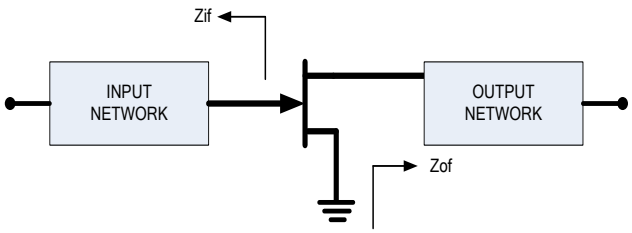
Absolute Maximum Ratings[2,3,4,5]

Parameter	Limit
Supply Voltage (V_{DD})	+65 V
Supply Voltage (V_{GS})	-8 to -2 V
Supply Current (I_{DMAX})	82 A
Input Power (P_{IN})	P_{IN} (nominal) + 3 dB
Absolute Max. Junction/Channel Temp	200ºC
Pulsed Power Dissipation at 85 ºC	2.3 kW
Thermal Resistance, (T_J= 70 ºC) V_{DD} = 50 V, I_{DQ} = 600 mA, Pout = 600 W, 32 µs Pulse / 2% Duty	0.05 ºC/W
Operating Temp	-40 to +95ºC
Storage Temp	-65 to +150ºC
Mounting Temperature	See solder reflow profile
ESD Min. - Charged Device Model (CDM)	1300 V
ESD Min. - Human Body Model (HBM)	4000 V

2. Operation of this device above any one of these parameters may cause permanent damage.
3. Input Power Limit is +3 dB over nominal drive required to achieve P_{OUT} = 600 W.
4. Channel temperature directly affects a device's MTTF. Channel temperature should be kept as low as possible to maximize lifetime.
5. For saturated performance it recommended that the sum of (3*V_{DD} + abs(V_{GG})) <175 V.

Test Fixture Impedances

F (MHz)	Z_{IF} (Ω)	Z_{OF} (Ω)
1030	1.1 - j1.5	1.5 + j0.5
1060	1.1 - j1.4	1.5 + j0.6
1090	1.1 - j1.3	1.5 + j0.6



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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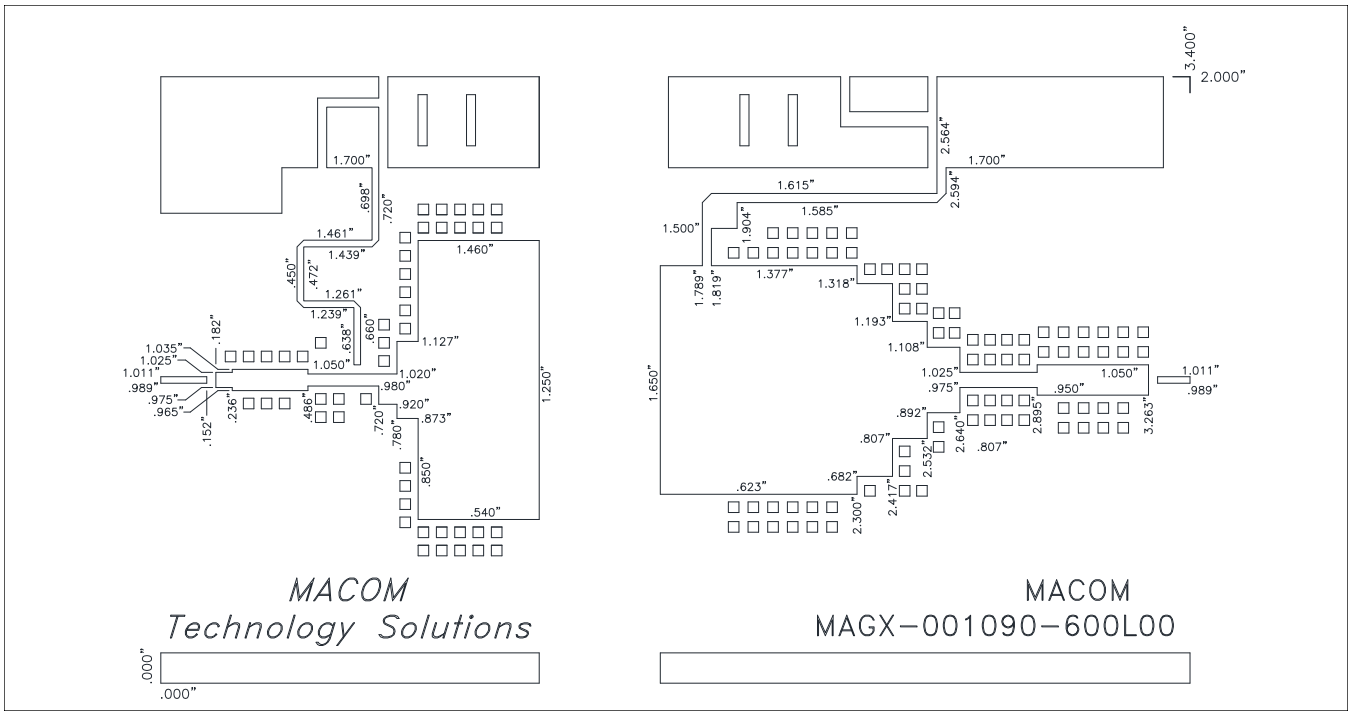
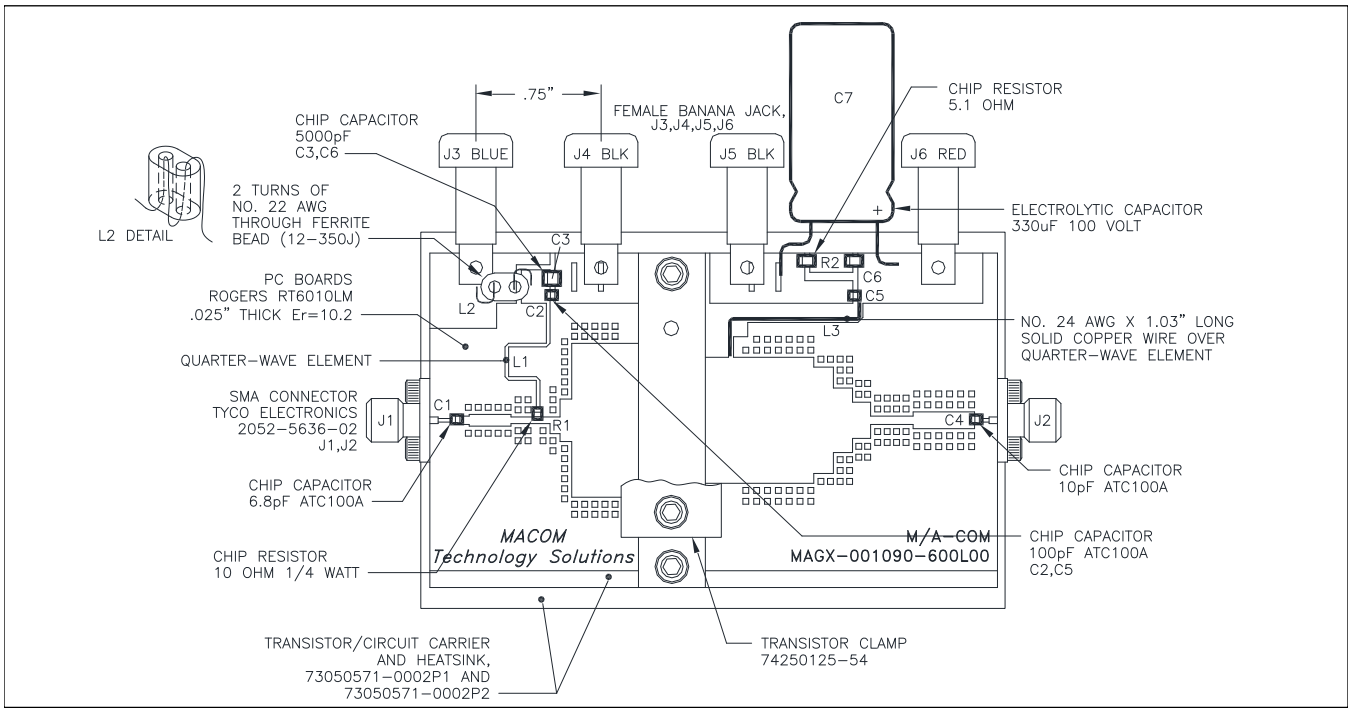
Test Fixture Circuit Dimensions



Test Fixture Assembly



Contact factory for gerber file or additional circuit information.

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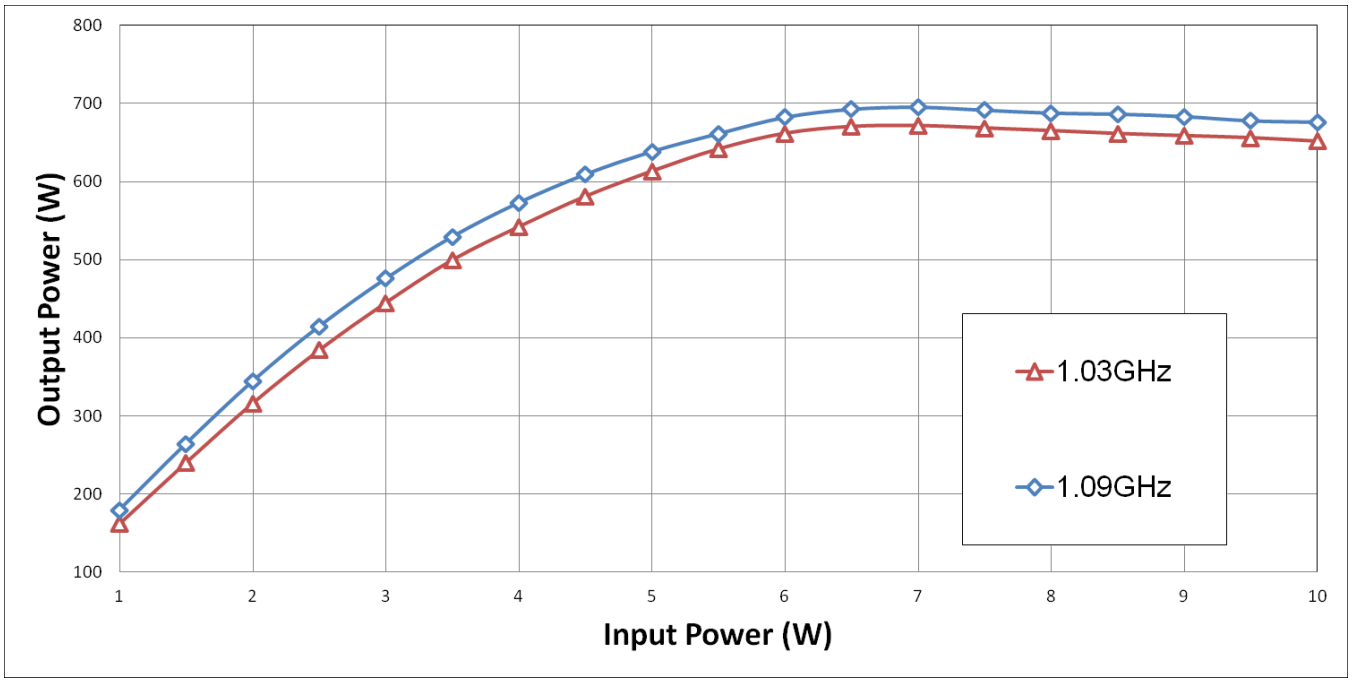
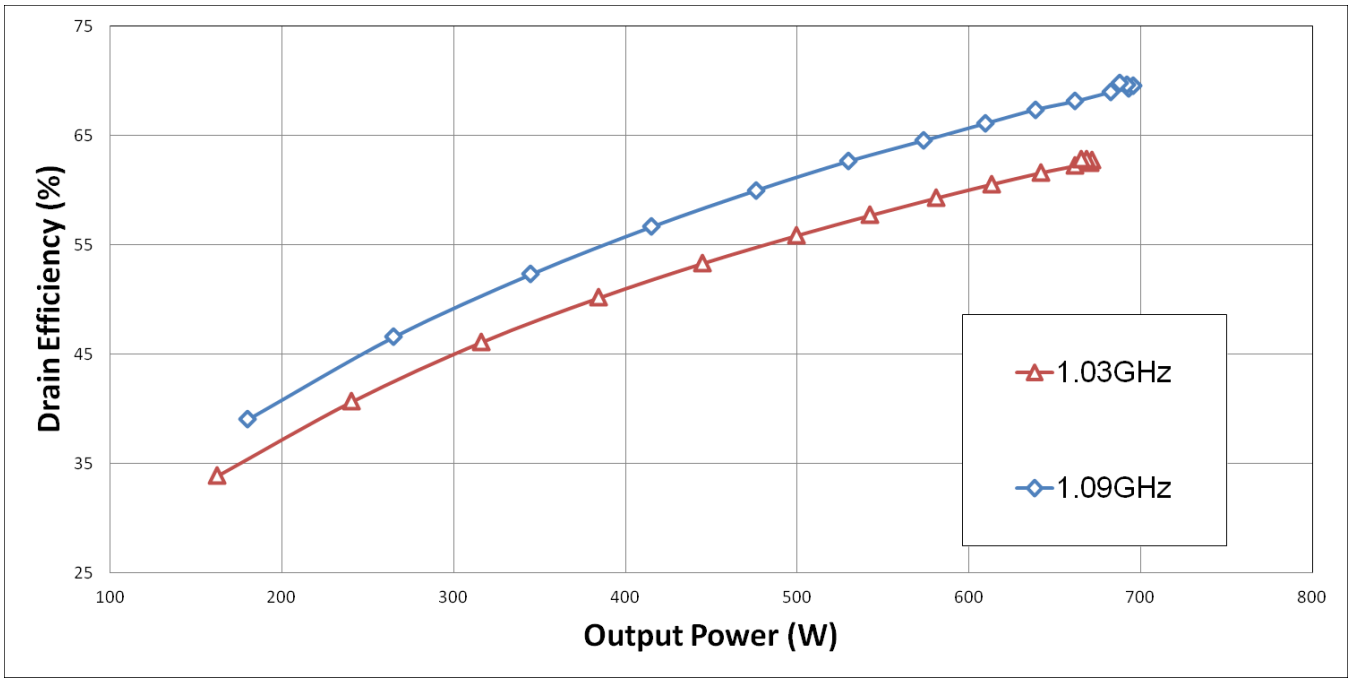
RF Power Transfer Curve (Output Power Vs. Input Power)



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



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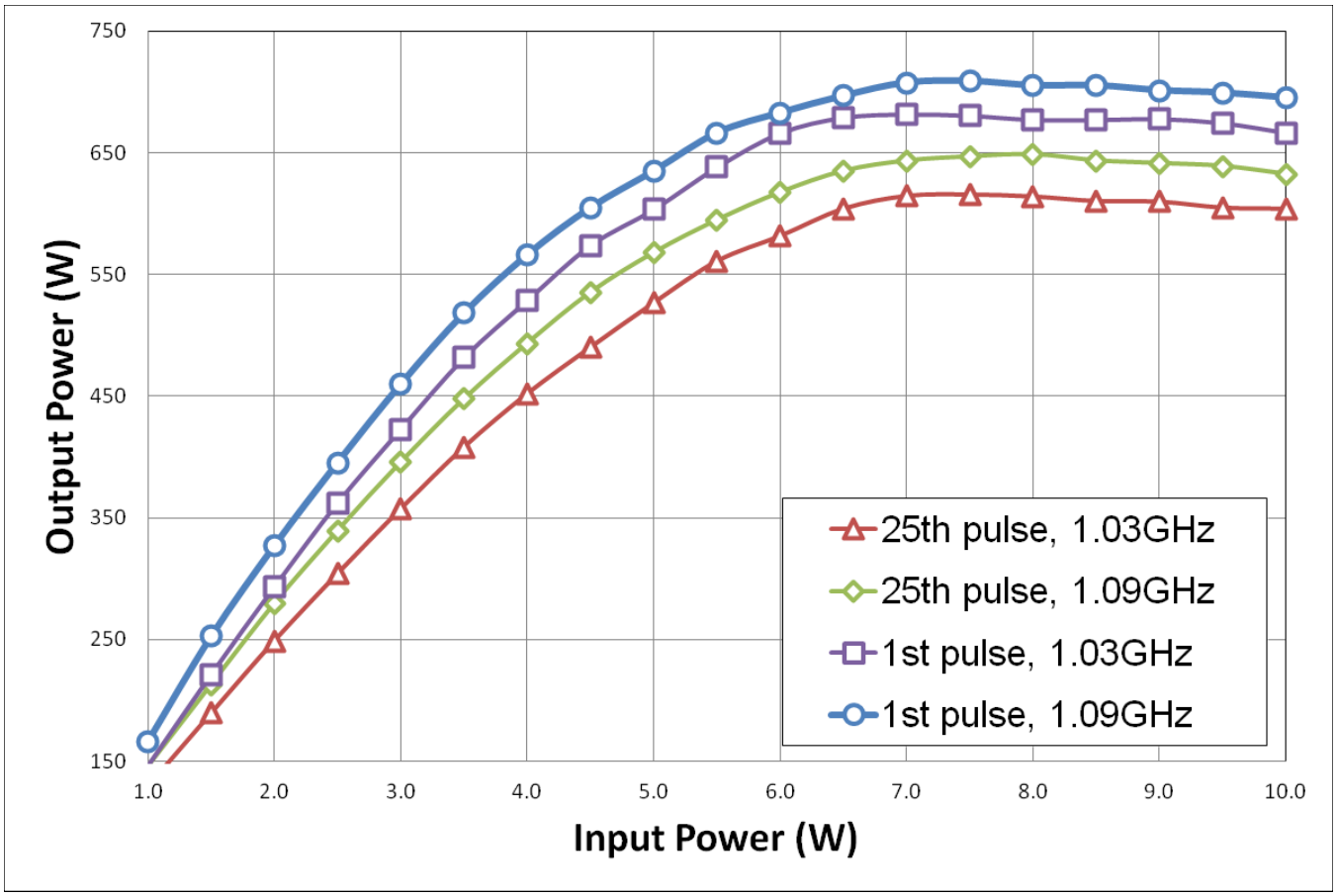
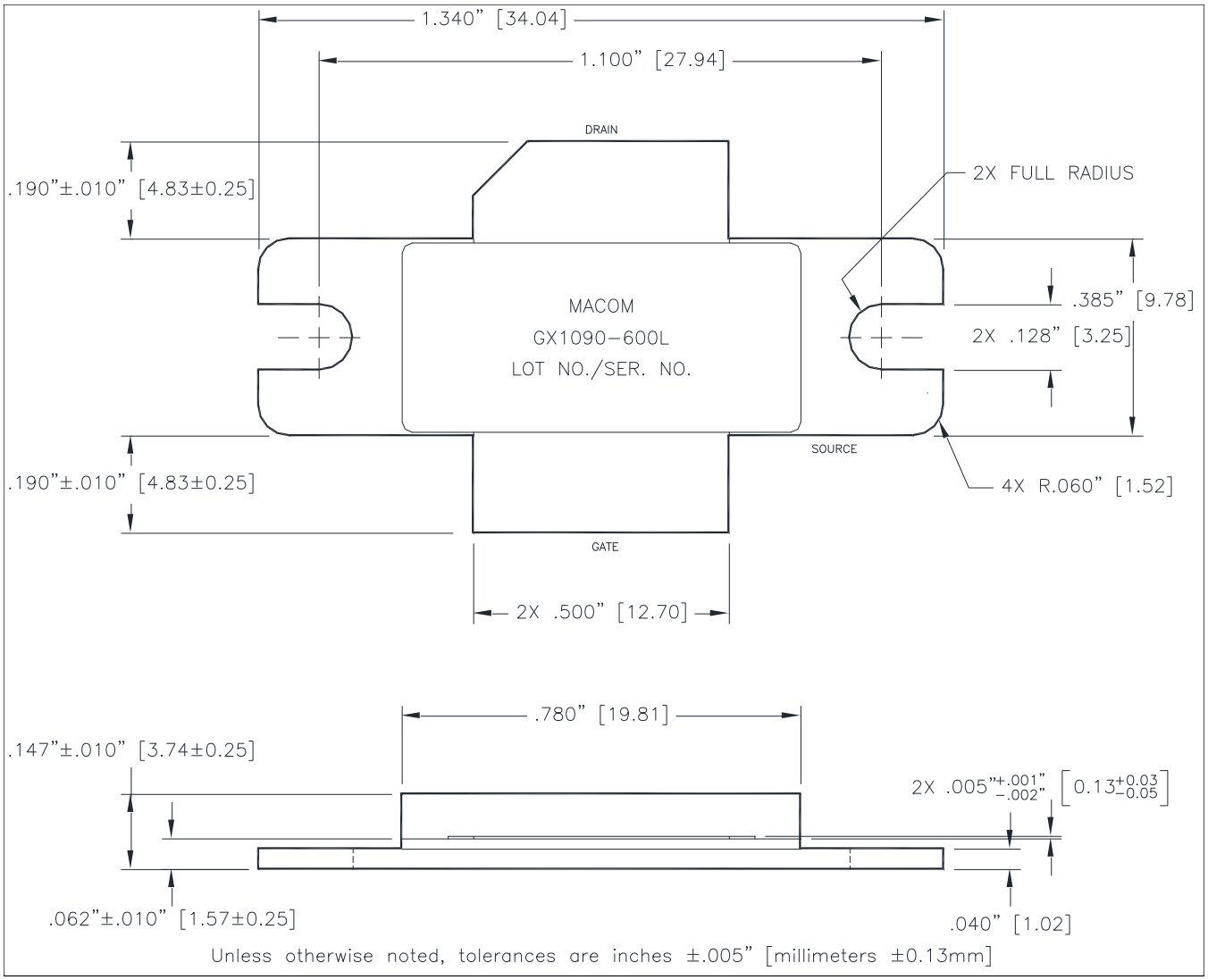
Typical RF Data with Mode-S ELM 'pulse' conditions:

48 pulses of 32 µs on and 18 µs off, repeat every 24ms; Overall Duty Factor = 6.4%

V_{DD} = 50 V; I_{DQ} = 400 mA



Outline Drawing MAGX-001090-600L00



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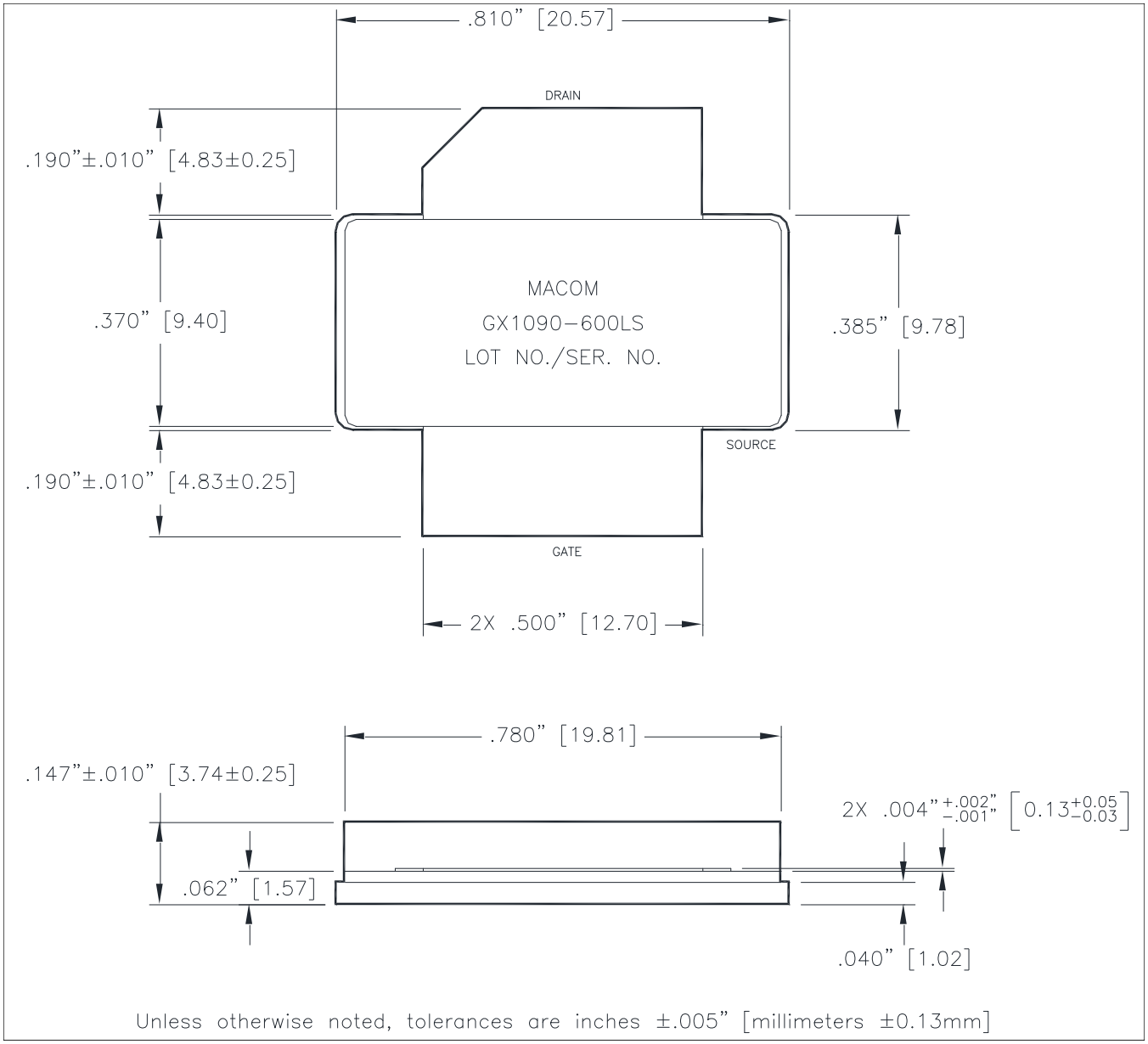

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