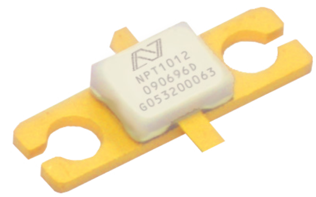
NPT1012

Gallium Nitride 28V, 25W RF Power Transistor

Built using the SIGANTIC® NRF1 process - A proprietary GaN-on-Silicon technology

FEATURES

- Optimized for broadband operation from DC-4000MHz
- 25W P_{3dB} CW power at 3000MHz
- 16-20W P_{3dB} CW power from 1000-2500MHz in application board with >45% drain efficiency
- 10-20W P_{3dB} CW power from 30-1000MHz in application board with >50% drain efficiency
- High efficiency from 14 - 28V
- 4.0 °C/W R_{TH} with maximum T_J rating of 200 °C
- Robust up to 10:1 VSWR mismatch at all angles with no device damage at 90 °C flange
- Subject to EAR99 export control



DC – 4000 MHz
25 Watt, 28 Volt
GaN HEMT

RoHS

RF Specifications (CW, 3000MHz): V_{DS} = 28V, I_{DQ} = 225mA, T_C = 25°C, Measured in Nitronex Test Fixture

Symbol	Parameter	Min	Typ	Max	Units
P_{3dB}	Average Output Power at 3dB Gain Compression	43	44	-	dBm
P_{1dB}	Average Output Power at 1dB Gain Compression	-	43	-	dBm
G_{SS}	Small Signal Gain	12	13	-	dB
η	Drain Efficiency at 3dB Gain Compression	57	65	-	%
VSWR	10:1 VSWR at all phase angles	No damage to the device			

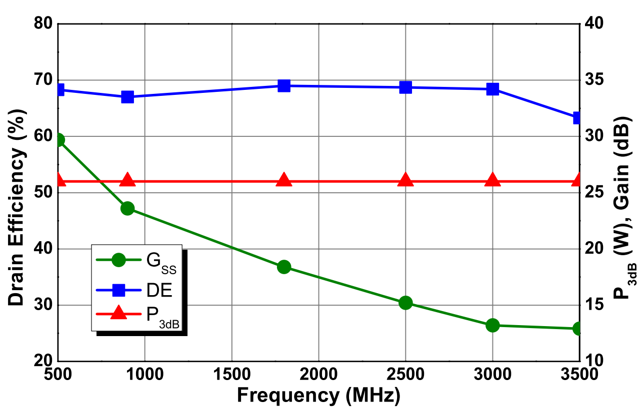


Figure 1 - Typical CW Performance in Load-Pull, V_{DS} = 28V, I_{DQ} = 225mA

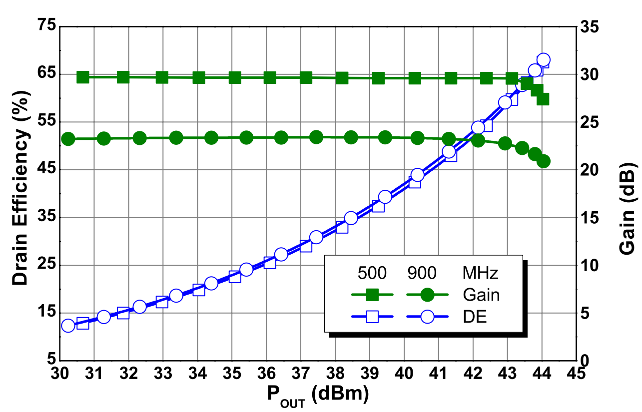


Figure 2 - Typical CW Performance[1] in Load-Pull, V_{DS} = 28V, I_{DQ} = 225mA

Note 1: 500MHz and 900MHz Load-Pull data collected using a 4.7 Ω resistor in the RF path added for stability

DC Specifications: T_C = 25°C

Symbol	Parameter	Min	Typ	Max	Units
Off Characteristics					
V_{BDS}	Drain-Source Breakdown Voltage (V_{GS} = -8V, I_D = 8mA)	100	-	-	V
I_{DLK}	Drain-Source Leakage Current (V_{GS} = -8V, V_{DS} = 60V)	-	-	4	mA
On Characteristics					
V_T	Gate Threshold Voltage (V_{DS} = 28V, I_D = 8mA)	-2.3	-1.8	-1.3	V
V_{GSQ}	Gate Quiescent Voltage (V_{DS} = 28V, I_D = 225mA)	-2.0	-1.5	-1.0	V
R_{ON}	On Resistance (V_{GS} = 2V, I_D = 60mA)	-	0.44	0.55	Ω
$I_{D,MAX}$	Drain Current (V_{DS} = 7V pulsed, 300μs pulse width, 0.2% duty cycle, V_{GS} = 2.0V)	-	5.4	-	A

Thermal Resistance Specification

Symbol	Parameter	Min	Typ	Max	Units
θ_{JC}	Thermal Resistance (Junction-to-Case), T_J = 180 °C	-	4.0	-	°C/W

Absolute Maximum Ratings: Not simultaneous, T_C = 25°C unless otherwise noted

Symbol	Parameter	Max	Units
V_{DS}	Drain-Source Voltage	100	V
V_{GS}	Gate-Source Voltage	-10 to 3	V
I_G	Gate Current	40	mA
P_T	Total Device Power Dissipation (Derated above 25°C)	44	W
T_{STG}	Storage Temperature Range	-65 to 150	°C
T_J	Operating Junction Temperature	200	°C
HBM	Human Body Model ESD Rating (per JESD22-A114)	1B (+/-500V)	
MM	Machine Model ESD Rating (per JESD22-A115)	A (>100V)	
CDM	Charge Device Model ESD Rating (per JESD22-C101)	IV (>1000V)	

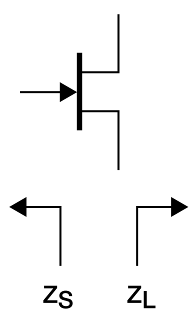
Load-Pull Data, Reference Plane at Device Leads

V_{DS}=28V, I_{DQ}=225mA, T_A=25°C unless otherwise noted

Table 1: Optimum Source and Load Impedances[1] for CW Gain, Drain Efficiency, and Output Power Performance

Frequency (MHz)	V_{DS} (V)	Z_S (Ω)	Z_L (Ω)	P_{SAT} (W)	G_{SS} (dB)	Drain Efficiency @ P_{SAT} (%)
500	14	7.0 + j8.2	8.6 + j7.4	12	27.8	76
500	22	7.0 + j8.2	9.7+ j11.3	21	29.2	74
500	28	7.0 + j8.2	9.7 + j14.1	26	29.7	68
900	14	5.8 + j3.1	6.8 + j4.7	12	22.4	74
900	22	5.8 + j3.1	9.6 + j5.3	24	23.3	74
900	28	5.8 + j3.1	9.8 + j 7.8	26	23.6	67
1800	28	3.5 - j3.6	6.9 + j2.0	26	18.4	69
2500	14	3.9 - j7.5	6.2 - j8.0	13	13.7	70
2500	22	4.8 - j7.0	5.5 - j4.1	19	14.9	69
2500	28	4.8 - j7.0	5.5 - j4.1	26	15.2	69
3000	28	5.3 - j8.8	5.3 - j6.4	26	13.2	66
3500	28	5.0 - j14.5	7.0 - j9.5	26	12.9	63

Note 1: 500MHz and 900MHz Load-Pull data collected using a 4.7 Ω resistor in the RF path added for stability



Z_S is the source impedance presented to the device.
Z_L is the load impedance presented to the device.

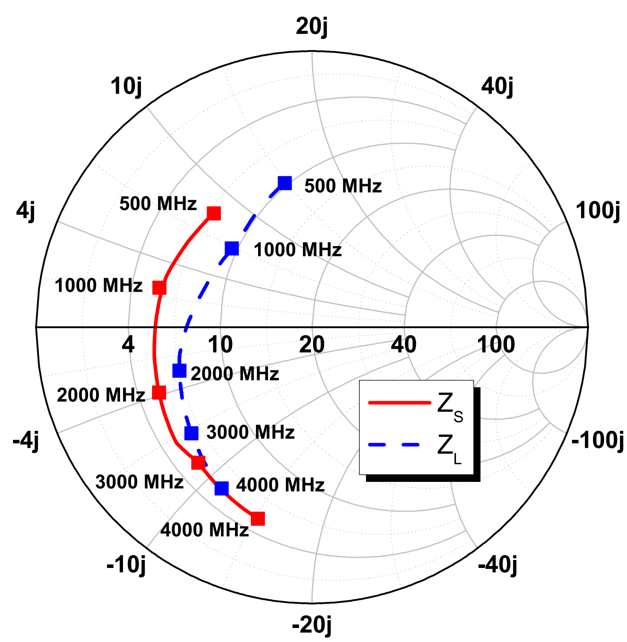


Figure 3 - Optimum Impedances for CW Performance, V_{DS} = 28V

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Load-Pull Data, Reference Plane at Device Leads

V_{DS}=28V, I_{DQ}=225mA, T_A=25°C unless otherwise noted

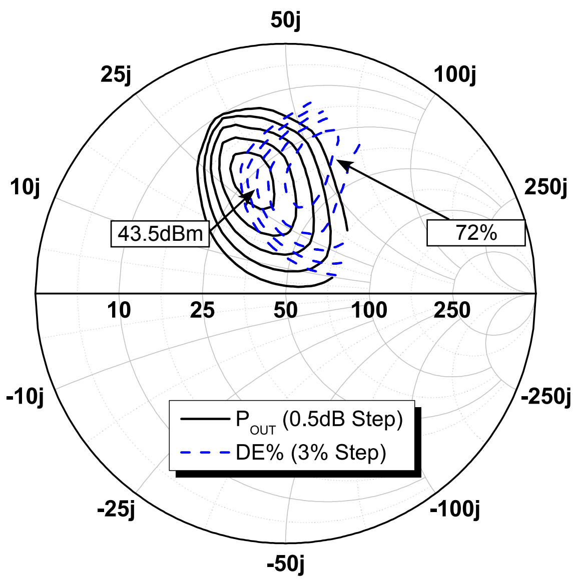

Figure 4 - Load-Pull Contours[1], 500MHz, P_{IN} = 14.5dBm, Z_S = 7.0 + j8.2 Ω

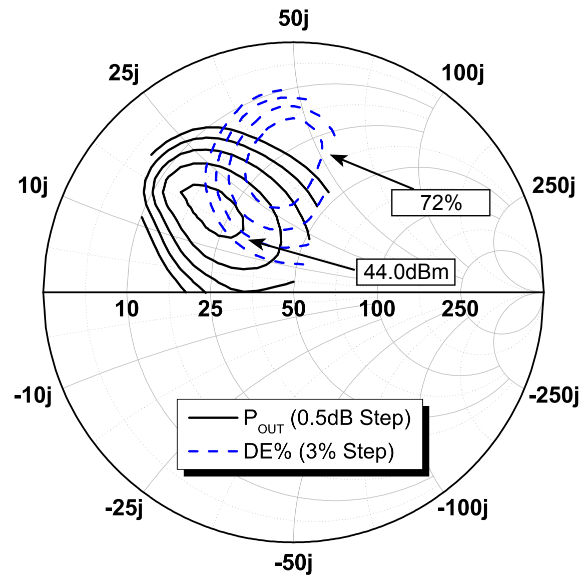

Figure 5 - Load-Pull Contours[1], 900MHz, P_{IN} = 21.0dBm, Z_S = 5.8 + j3.1 Ω

Note 1: 500MHz and 900MHz Load-Pull data collected using a 4.7 Ω resistor in the RF path added for stability

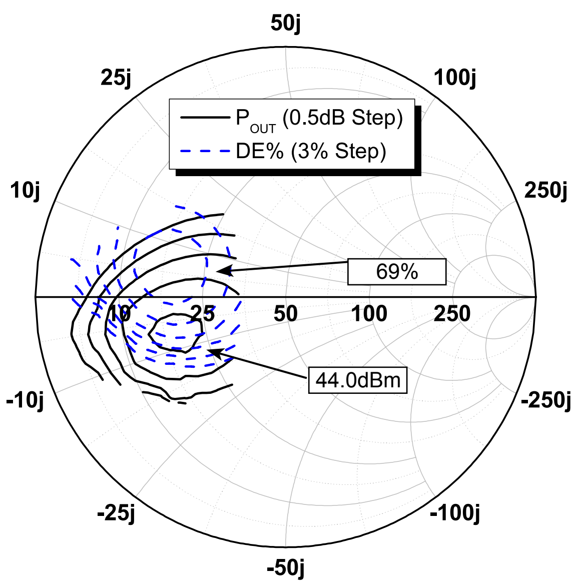

Figure 6 - Load-Pull Contours, 1800MHz, P_{IN} = 26.5dBm, Z_S = 3.5 - j3.6 Ω

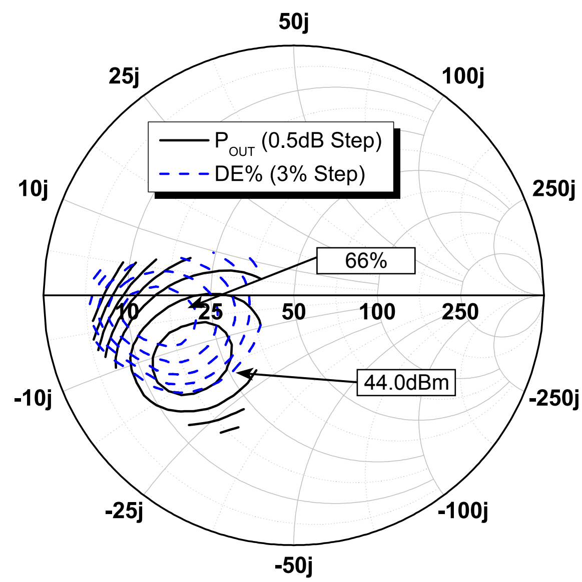

Figure 7 - Load-Pull Contours, 2500MHz, P_{IN} = 29.4dBm, Z_S = 4.8 - j7.0 Ω

Load-Pull Data, Reference Plane at Device Leads

V_{DS}=28V, I_{DQ}=225mA, T_A=25°C unless otherwise noted

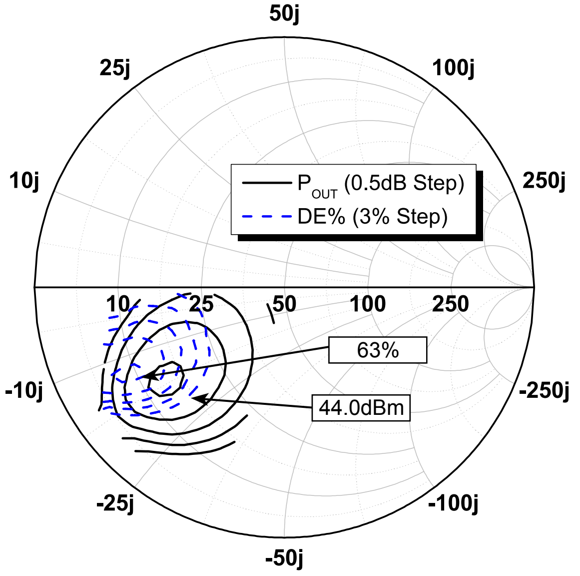

Figure 8 - Load-Pull Contours, 3000MHz, P_{IN} = 31.7dBm, Z_S = 5.3 - j8.8 Ω

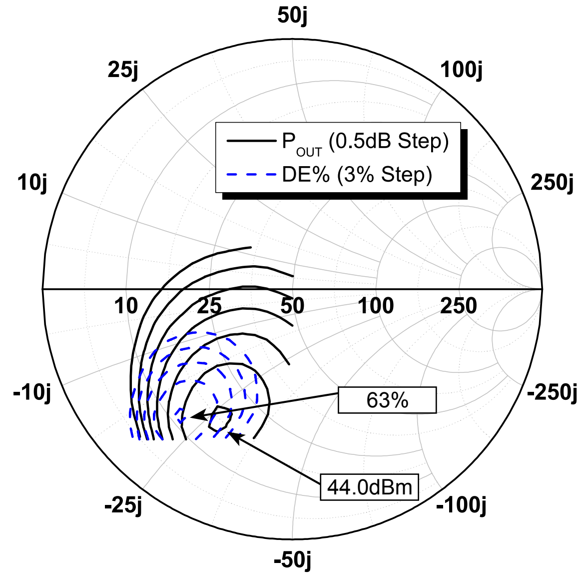

Figure 9 - Load-Pull Contours, 3500MHz, P_{IN} = 33.5dBm, Z_S = 5.0 - j14.5 Ω

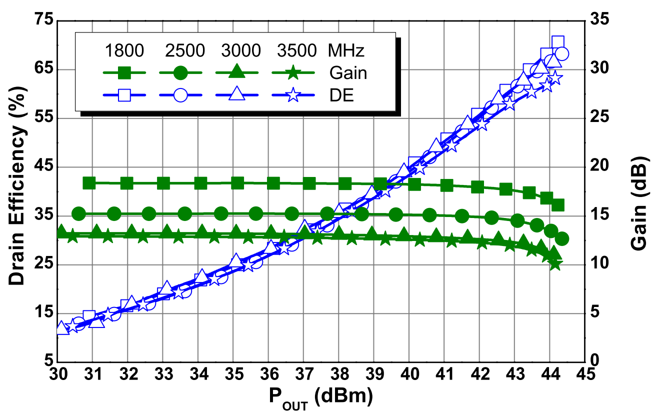

Figure 10 - Typical CW Performance in Load-Pull

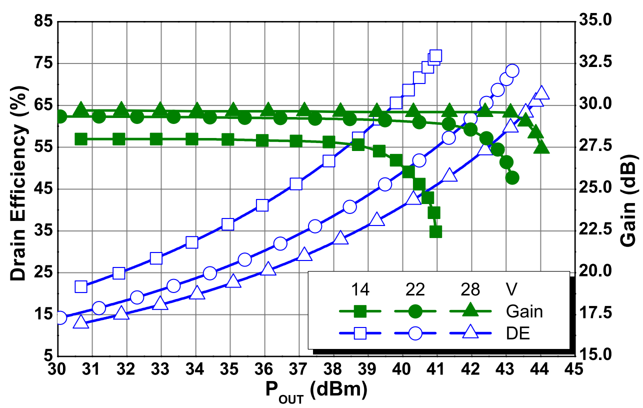

Figure 11 - Typical CW Performance[1] Over Voltage in Load-Pull, 500MHz

Note 1: 500MHz and 900MHz Load-Pull data collected using a 4.7 Ω resistor in the RF path added for stability

Load-Pull Data, Reference Plane at Device Leads

V_{DS}=28V, I_{DQ}=225mA, T_A=25°C unless otherwise noted

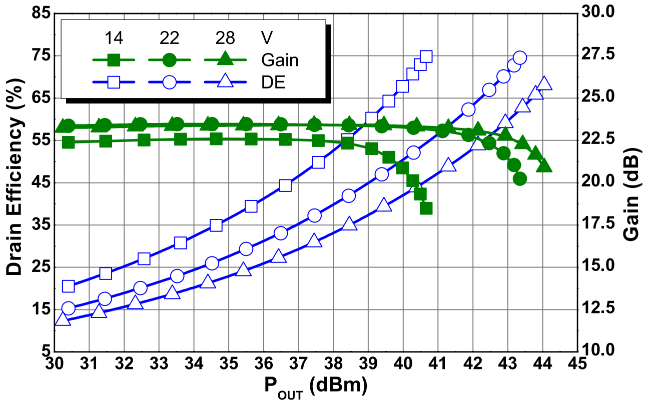

Figure 12 - Typical CW Performance[1] Over Voltage in Load-Pull, 900MHz

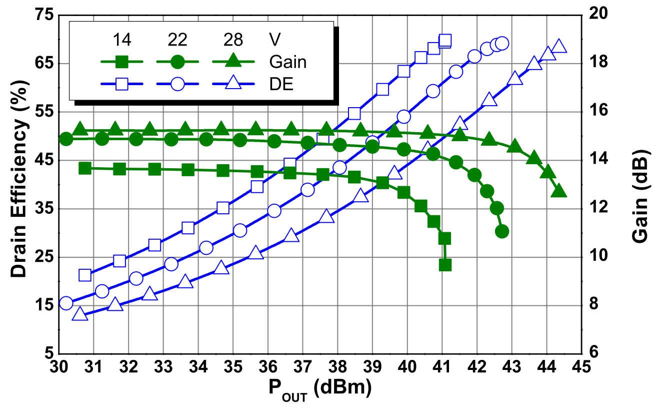

Figure 13 - Typical CW Performance Over Voltage in Load-Pull, 2500MHz

Note 1: 500MHz and 900MHz Load-Pull data collected using a 4.7 Ω resistor in the RF path added for stability

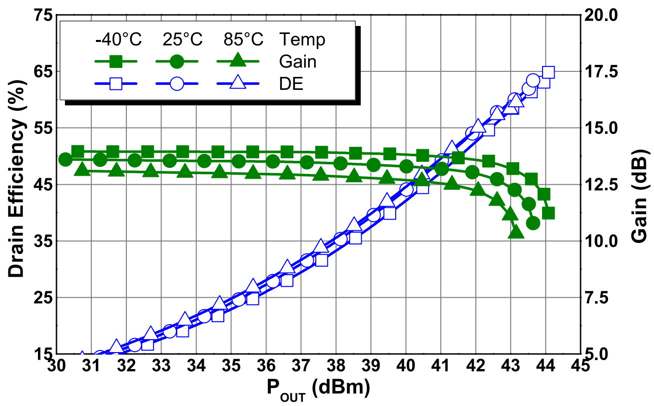

Figure 14 - Typical CW Performance Over Temperature in Nitronex Test Fixture, 3000MHz

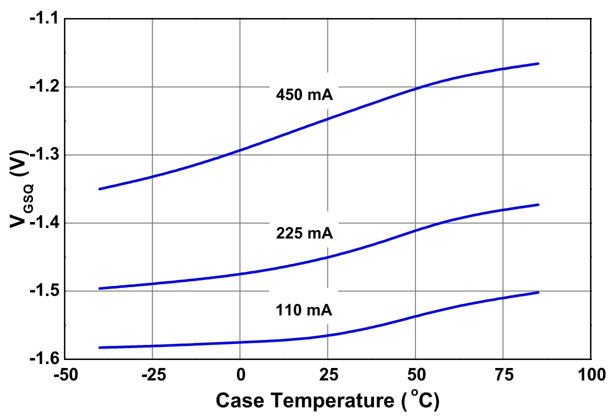

Figure 15 - Quiescent Gate Voltage (V_{GSQ}) Required to Reach I_{DQ} as a Function of Case Temperature, V_{DS} = 28V

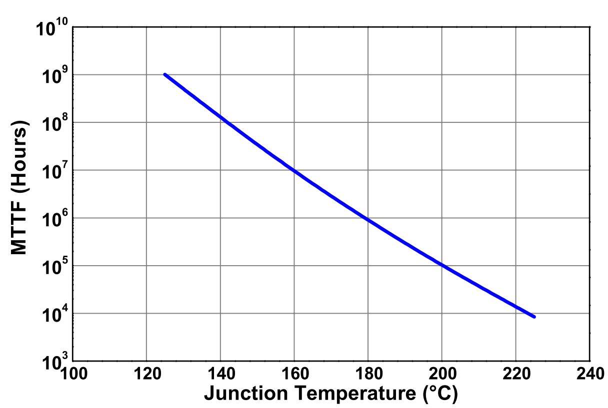

Figure 16 - MTTF of NRF1 Devices as a Function of Junction Temperature

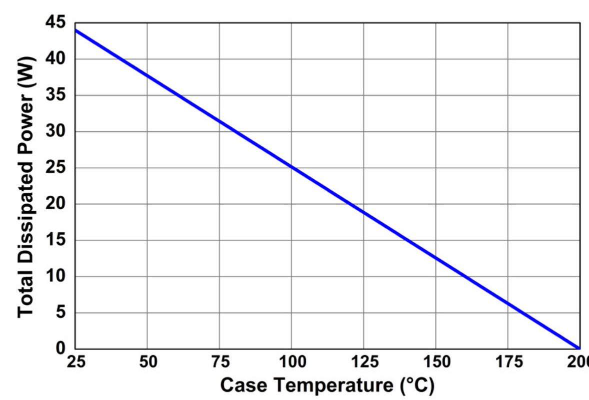

Figure 17 - Power Derating Curve

Ordering Information[1]

Part Number	Description
NPT1012B	NPT1012 in AC200B-2 Metal-Ceramic Bolt-Down Package

1: To find a Nitronex contact in your area, visit our website at http://www.nitronex.com

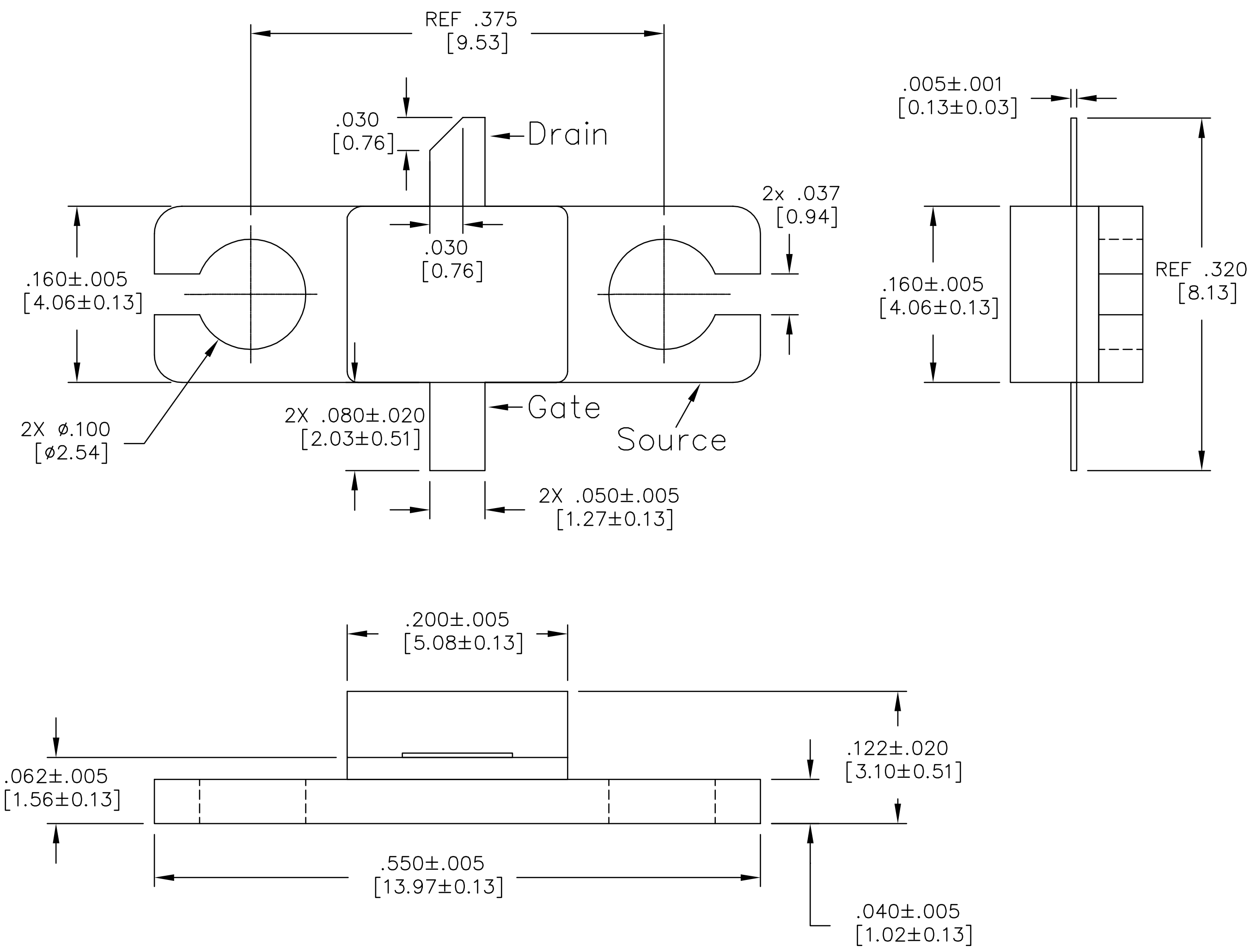

Figure 18 - AC200B-2 Metal-Ceramic Package Dimensions and Pinout (all dimensions are in inches [mm])

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Additional Information

This part is lead-free and is compliant with the RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

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