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			

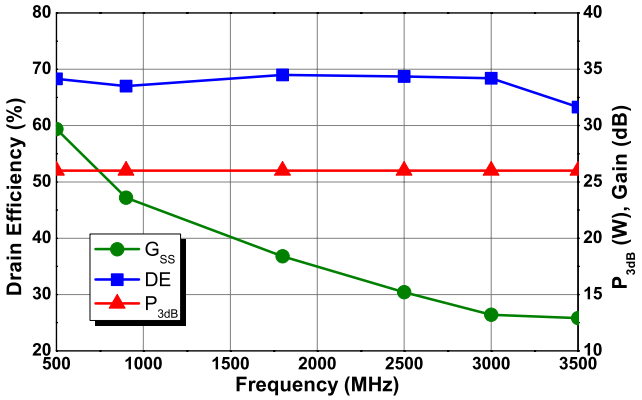


Figure 1 - Typical CW Performance in Load-Pull, V_{DS} = 28V, I_{DQ} = 225mA

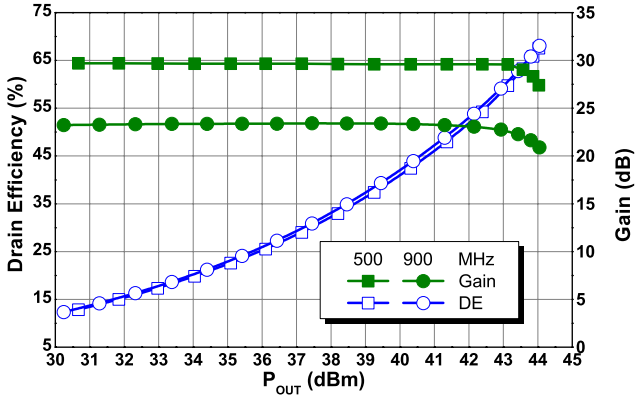


Figure 2 - Typical CW Performance[1] in Load-Pull, V_{DS} = 28V, I_{DQ} = 225mA

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)	

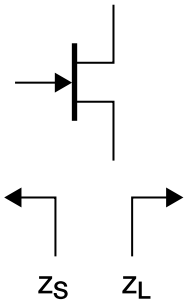
Load-Pull Data, Reference Plane at Device Leads

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.

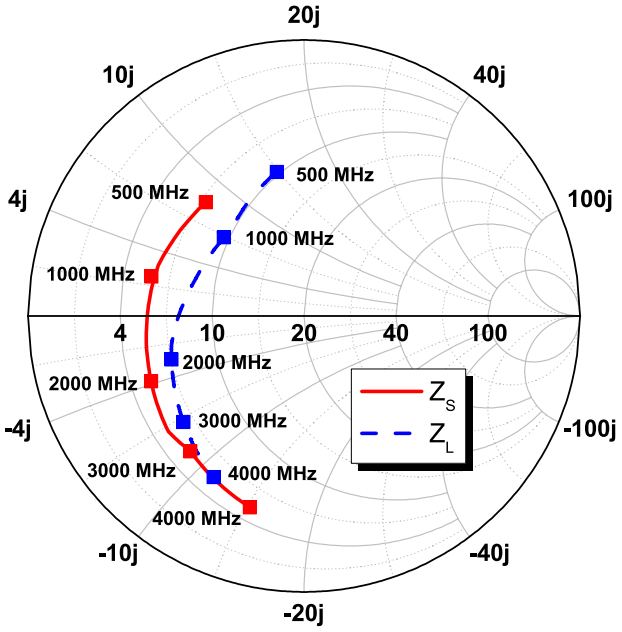


Figure 3 - Optimum Impedances for CW Performance, V_{DS} = 28V

Load-Pull Data, Reference Plane at Device Leads

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

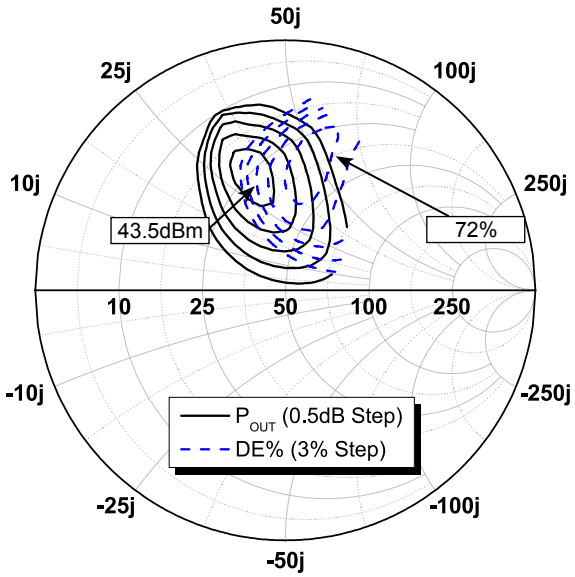


Figure 4 - Load-Pull Contours[1], 500MHz, P_{IN} = 14.5dBm, Z_S = 7.0 + j8.2 Ω

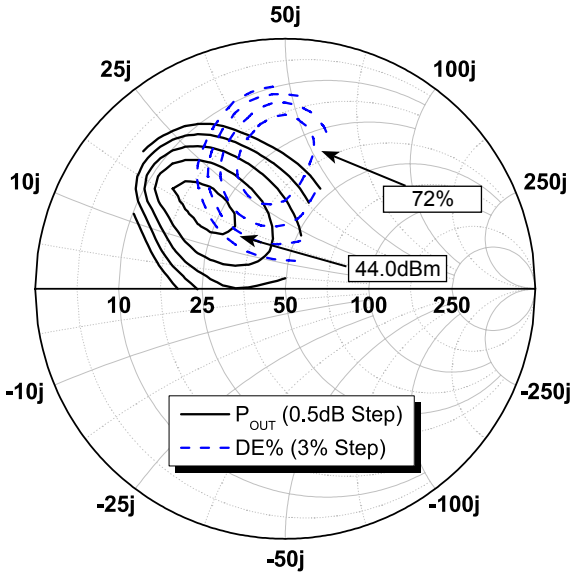


Figure 5 - Load-Pull Contours[1], 900MHz, P_{IN} = 21.0dBm, Z_S = 5.8 + j3.1 Ω

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

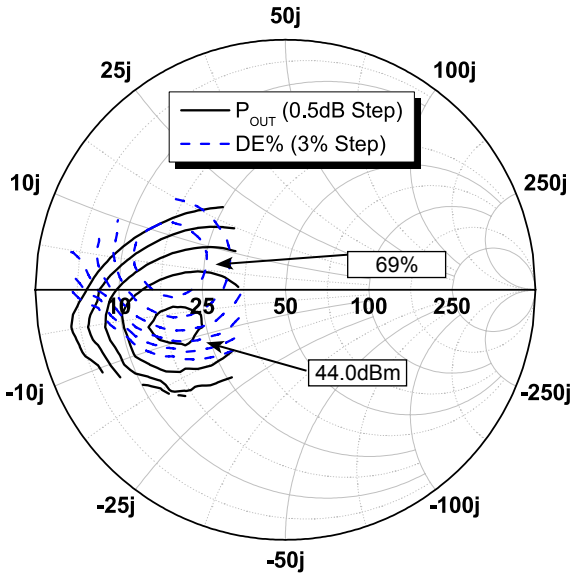


Figure 6 - Load-Pull Contours, 1800MHz, P_{IN} = 26.5dBm, Z_S = 3.5 - j3.6 Ω

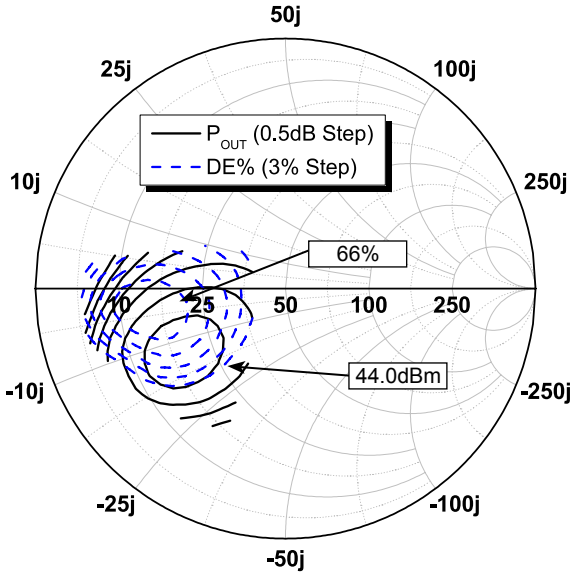


Figure 7 - Load-Pull Contours, 2500MHz, P_{IN} = 29.4dBm, Z_S = 4.8 - j7.0 Ω

Load-Pull Data, Reference Plane at Device Leads

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

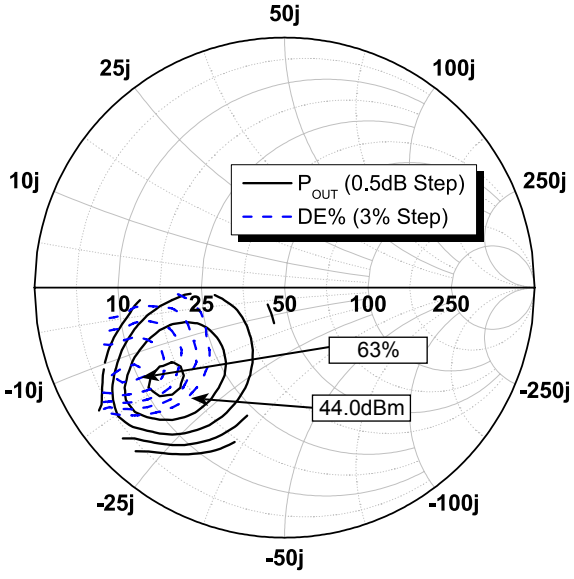


Figure 8 - Load-Pull Contours, 3000MHz, P_{IN} = 31.7dBm, Z_S = 5.3 - j8.8 Ω

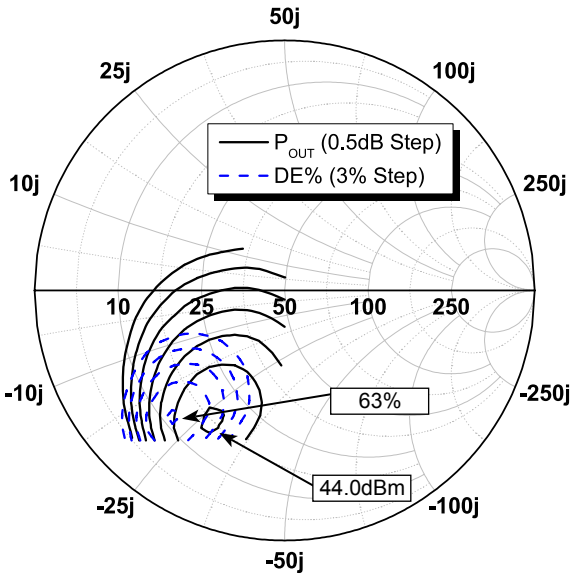


Figure 9 - Load-Pull Contours, 3500MHz, P_{IN} = 33.5dBm, Z_S = 5.0 - j14.5 Ω

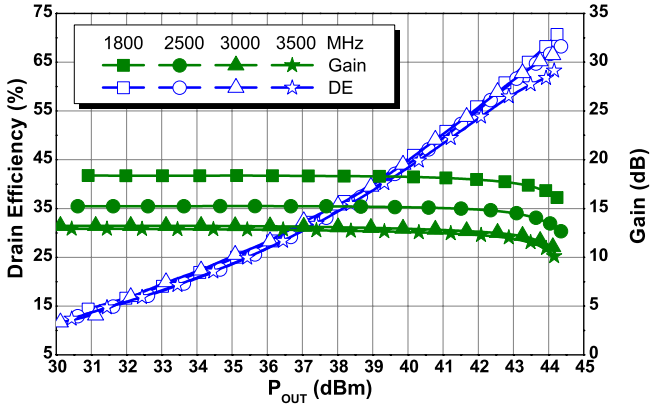


Figure 10 - Typical CW Performance in Load-Pull

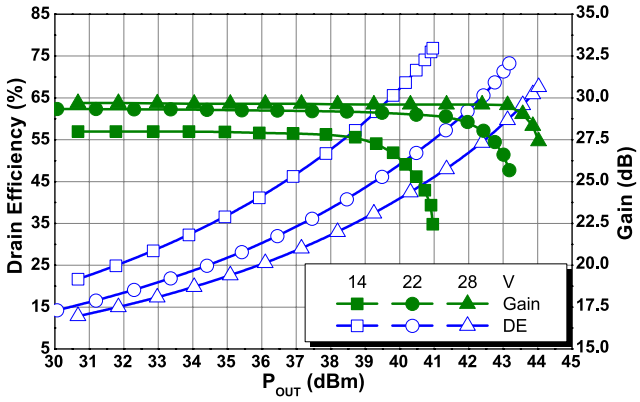


Figure 11 - Typical CW Performance[1] Over Voltage in Load-Pull, 500MHz

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

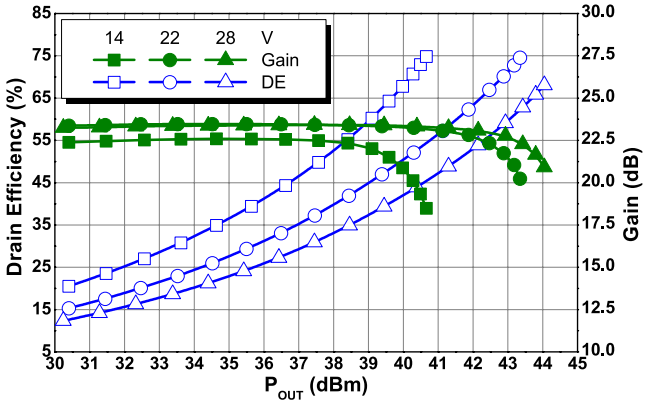


Figure 12 - Typical CW Performance[1] Over Voltage in Load-Pull, 900MHz

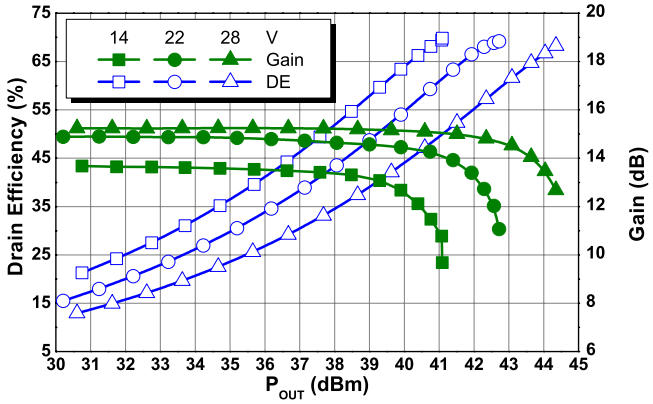


Figure 13 - Typical CW Performance Over Voltage in Load-Pull, 2500MHz

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

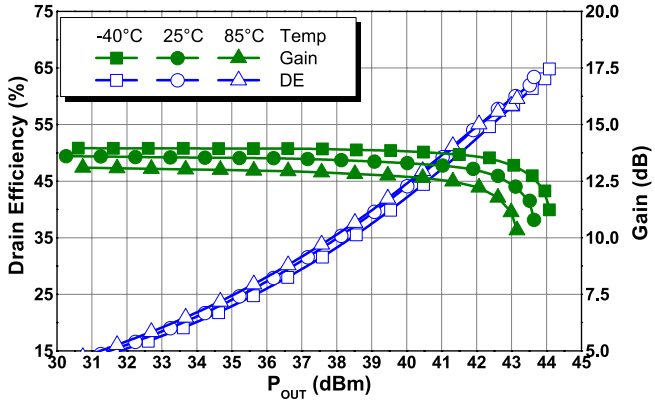


Figure 14 - Typical CW Performance Over Temperature in Nitronex Test Fixture, 3000MHz

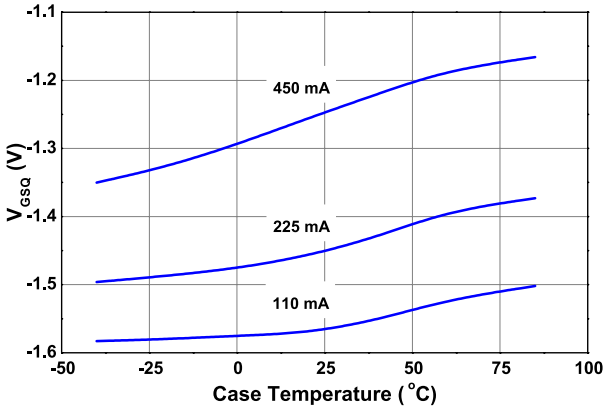


Figure 15 - Quiescent Gate Voltage (V_{GSQ}) Required to Reach I_{DQ} as a Function of Case Temperature, V_{DS} = 28V

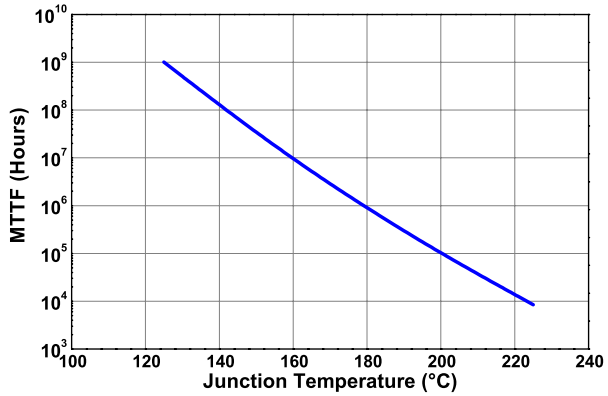


Figure 16 - MTTF of NRF1 Devices as a Function of Junction Temperature

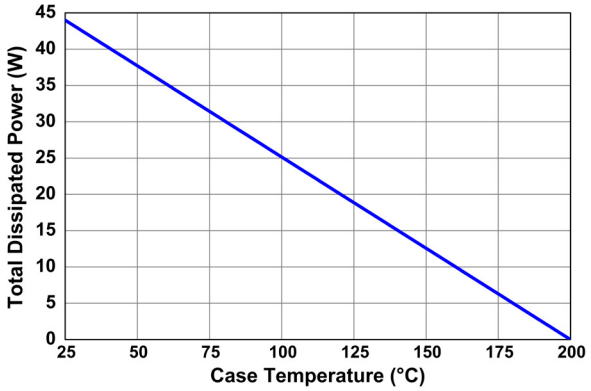


Figure 17 - Power Derating Curve

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

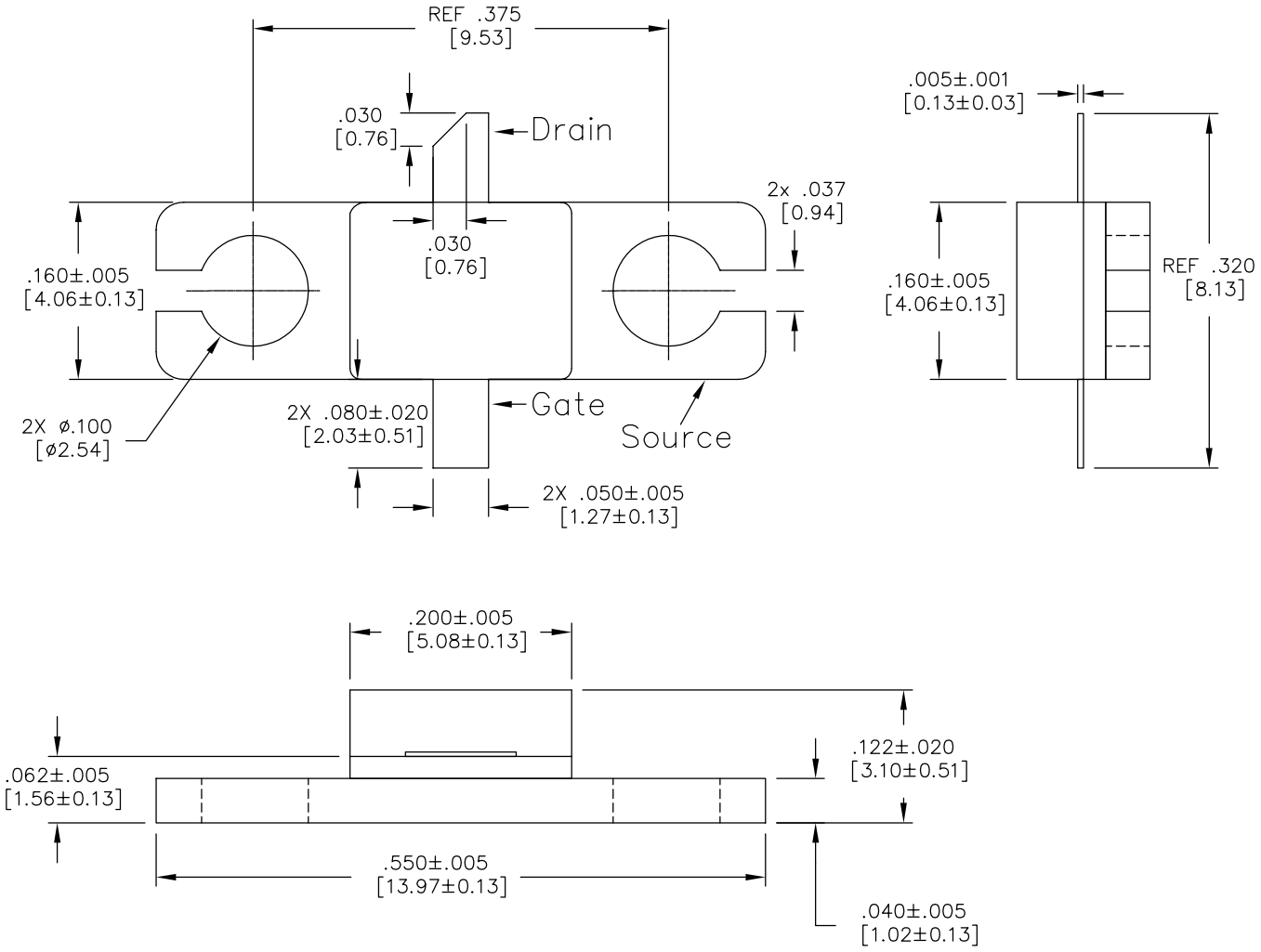


Figure 18 - AC200B-2 Metal-Ceramic Package Dimensions and Pinout (all dimensions are in inches [mm])

Nitronex, LLC
2305 Presidential Drive
Durham, NC 27703 USA
+1.919.807.9100 (telephone)
+1.919.807.9200 (fax)
info@nitronex.com
www.nitronex.com

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).

Important Notice

Nitronex, LLC reserves the right to make corrections, modifications, enhancements, improvements and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to Nitronex terms and conditions of sale supplied at the time of order acknowledgment. The latest information from Nitronex can be found either by calling Nitronex at 1-919-807-9100 or visiting our website at www.nitronex.com.

Nitronex warrants performance of its packaged semiconductor or die to the specifications applicable at the time of sale in accordance with Nitronex standard warranty. Testing and other quality control techniques are used to the extent Nitronex deems necessary to support the warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

Nitronex assumes no liability for applications assistance or customer product design. Customers are responsible for their product and applications using Nitronex semiconductor products or services. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

Nitronex does not warrant or represent that any license, either express or implied, is granted under any Nitronex patent right, copyright, mask work right, or other Nitronex intellectual property right relating to any combination, machine or process in which Nitronex products or services are used.

Reproduction of information in Nitronex data sheets is permitted if and only if said reproduction does not alter any of the information and is accompanied by all associated warranties, conditions, limitations and notices. Any alteration of the contained information invalidates all warranties and Nitronex is not responsible or liable for any such statements.

Nitronex products are not intended or authorized for use in life support systems, including but not limited to surgical implants into the body or any other application intended to support or sustain life. Should Buyer purchase or use Nitronex, LLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold Nitronex, LLC, its officers, employees, subsidiaries, affiliates, distributors, and its successors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, notwithstanding if such claim alleges that Nitronex was negligent regarding the design or manufacture of said products.

Nitronex and the Nitronex logo are registered trademarks of Nitronex, LLC.
All other product or service names are the property of their respective owners.
©Nitronex, LLC 2012. All rights reserved.