

## Gallium Nitride 28V, 200W RF Power Transistor

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

### FEATURES

- Optimized for narrowband and broadband applications from DC – 1200MHz
- 200W P<sub>3dB</sub> CW power at 900MHz in quadrature combined or push-pull configuration
- 90W CW power from 500-1000MHz in application design [AD-014](#)
- High efficiency from 14V to 28V
- 1.0 °C/W R<sub>TH</sub> with maximum T<sub>J</sub> rating of 200°C
- Robust up to 10:1 VSWR mismatch at all angles with no device degradation
- Subject to EAR99 export control



**DC – 1200 MHz**  
**14 – 28 Volt**  
**GaN HEMT**



**RF Specifications (CW):** V<sub>DS</sub> = 28V, I<sub>DQ</sub> = 1400mA<sup>1</sup>, Frequency = 900MHz, T<sub>A</sub> = 25°C, Measured in Nitronex Quadrature Combined Test Fixture<sup>2</sup>.

Symbol	Parameter	Min	Typ	Max	Units
P <sub>3dB</sub>	Average Output Power at 3dB Gain Compression	52.0	53.0	-	dBm
G <sub>SS</sub>	Small Signal Gain	17.3	18.3	-	dB
η	Drain Efficiency at 3dB Gain Compression <sup>2</sup>	57	63	-	%
VSWR	10:1 VSWR at all phase angles	No change in device performance			

Note 1: 700mA per transistor. Each gate should be biased independently to set desired I<sub>DQ</sub>.

Note 2: Includes ~ 0.2 dB quadrature combiner loss.

**Typical 2-Tone Performance:** V<sub>DS</sub> = 28V, I<sub>DQ</sub> = 1400mA<sup>1</sup>, Frequency = 900MHz, Tone spacing = 1MHz, T<sub>A</sub> = 25°C Measured in Nitronex Quadrature Combined Test Fixture<sup>2</sup>.

Symbol	Parameter	Typ	Units
P <sub>3dB,PEP</sub>	Peak Envelope Power at 3dB Gain Compression	53.4	dBm
P <sub>1dB,PEP</sub>	Peak Envelope Power at 1dB Gain Compression	52.6	dBm
P <sub>IMD3</sub>	Peak Envelope Power at -35dBc IMD3	50.8	dBm

Note 1: 700mA per transistor. Each gate should be biased independently to set desired I<sub>DQ</sub>.

Note 2: Includes ~ 0.2 dB quadrature combiner loss.

**DC Specifications:** Per Transistor,  $T_A = 25^\circ\text{C}$

Symbol	Parameter	Min	Typ	Max	Units
<b>Off Characteristics</b>					
$V_{BDS}$	Drain-Source Breakdown Voltage ( $V_{GS} = -8\text{V}$ , $I_D = 36\text{mA}$ )	100	-	-	V
$I_{DLK}$	Drain-Source Leakage Current ( $V_{GS} = -8\text{V}$ , $V_{DS} = 60\text{V}$ )	-	9	18	mA
<b>On Characteristics</b>					
$V_T$	Gate Threshold Voltage ( $V_{DS} = 28\text{V}$ , $I_D = 36\text{mA}$ )	-2.3	-1.8	-1.3	V
$V_{GSQ}$	Gate Quiescent Voltage ( $V_{DS} = 28\text{V}$ , $I_D = 700\text{mA}$ )	-2.0	-1.5	-1.0	V
$R_{ON}$	On Resistance ( $V_{GS} = 2\text{V}$ , $I_D = 270\text{mA}$ )	-	0.13	0.14	$\Omega$
$I_{D,MAX}$	Drain Current ( $V_{DS} = 7\text{V}$ pulsed, 300 $\mu\text{s}$ pulse width, 0.2% duty cycle)	19.0	20.5	-	A

**Absolute Maximum Ratings:** Not Simultaneous, Per Transistor,  $T_A = 25^\circ\text{C}$  Unless Otherwise Noted

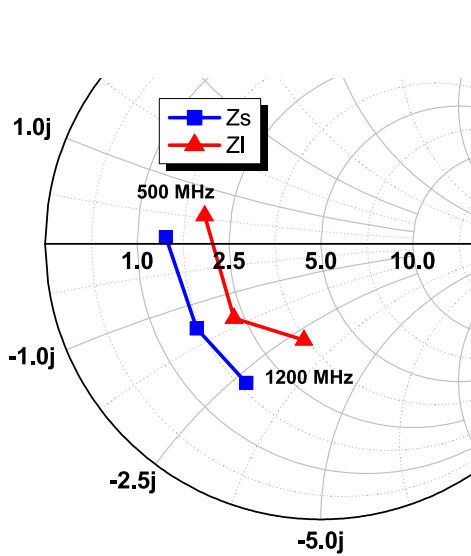
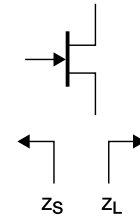
Symbol	Parameter	Max	Units
$V_{DS}$	Drain-Source Voltage	100	V
$V_{GS}$	Gate-Source Voltage	-10 to 3	V
$I_G$	Gate Current	180	mA
$P_T$	Total Device Power Dissipation (Derated above $25^\circ\text{C}$ ), both transistors on	175	W
$\theta_{JC}$	Thermal Resistance (Junction-to-Case), composite for both transistors on, $T_J = 180^\circ\text{C}$	1.0	$^\circ\text{C}/\text{W}$
	Thermal Resistance (Junction-to-Case), one transistor on, one off, $T_J = 180^\circ\text{C}$	1.8	
$T_{STG}$	Storage Temperature Range	-65 to 150	$^\circ\text{C}$
$T_J$	Operating Junction Temperature	200	$^\circ\text{C}$
HBM	Human Body Model ESD Rating (per JESD22-A114)	1C (>1000V)	
MM	Machine Model ESD Rating (per JESD22-A115)	A (>100V)	
CDM	Charge Device Model ESD Rating (per JESD22-C101)	IV (>4000V)	

## Load-Pull Data, Reference Plane at Device Leads

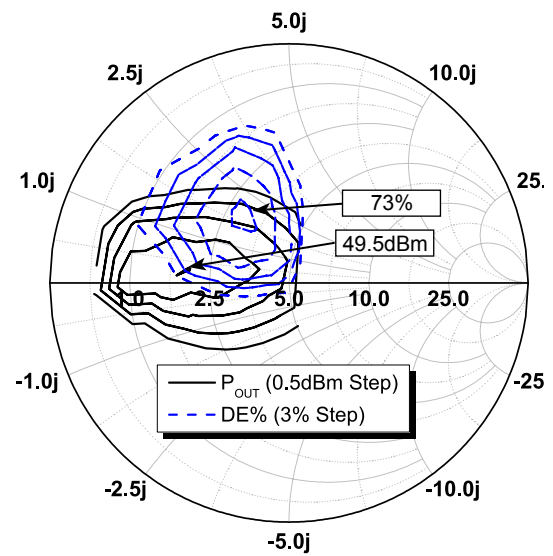
$V_{DS}=28V$ ,  $I_{DQ}=700mA$ , One Single-Ended Transistor,  $T_A=25^\circ C$  Unless Otherwise Noted

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

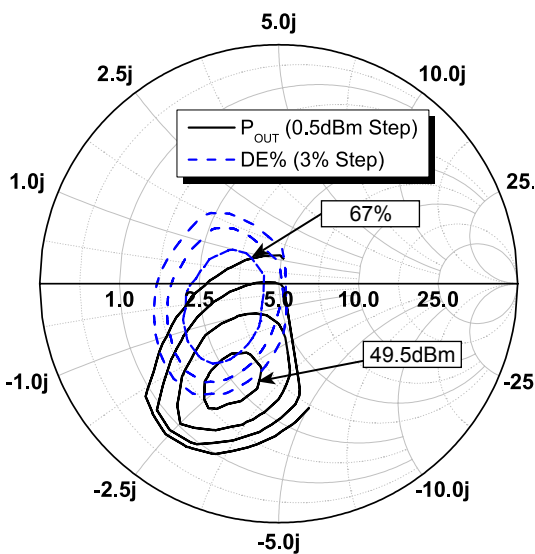
Frequency (MHz)	$Z_S (\Omega)$	$Z_L (\Omega)$	$P_{SAT}$ (dBm)	$G_{SS}$ (dB)	Drain Efficiency @ $P_{SAT}$ (%)
500	$1.4 + j0.1$	$2.0 + j0.5$	50.0	24.0	70%
900	$1.6 - j1.5$	$2.3 - j1.5$	50.0	18.5	74%
1200	$1.8 - j2.7$	$3.5 - j2.8$	49.5	16.5	62%



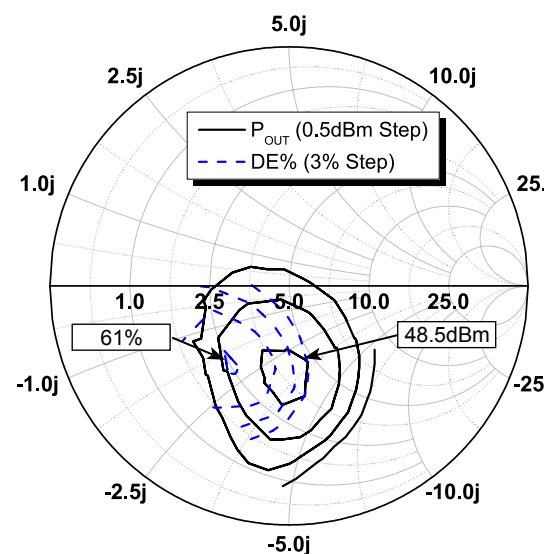
**Figure 1 -** Optimum Impedances for CW Performance



**Figure 2 -** Load-Pull Contours, 500MHz,  $P_{IN} = 25dBm$ ,  $Z_S = 1.4 + j0.1 \Omega$



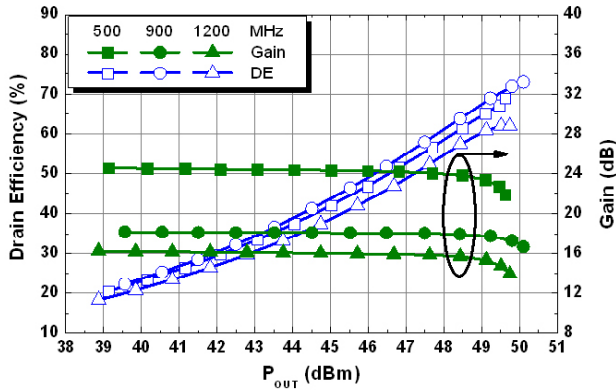
**Figure 3 -** Load-Pull Contours, 900MHz,  $P_{IN} = 30dBm$ ,  $Z_S = 1.6 - j1.5 \Omega$



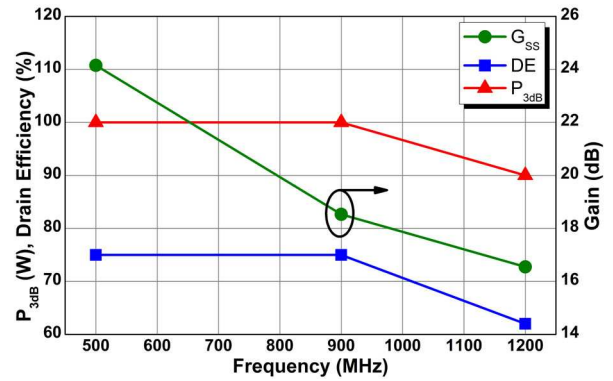
**Figure 4 -** Load-Pull Contours, 1200MHz,  $P_{IN} = 32dBm$ ,  $Z_S = 1.8 - j2.7 \Omega$

## Load-Pull Data per Device Lead, Reference Plane at Device Leads

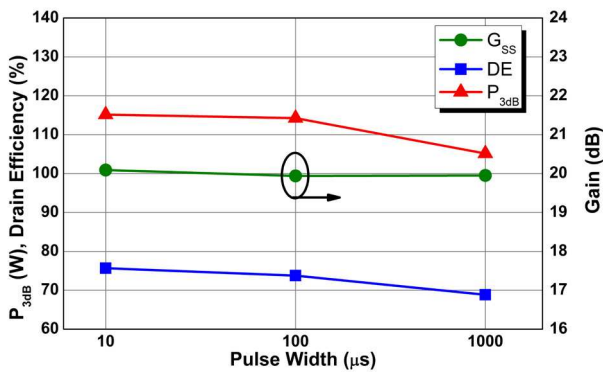
$V_{DS}=28V$ ,  $I_{DQ}=700mA$ , One Single-Ended Transistor,  $T_A=25^\circ C$  unless otherwise noted.



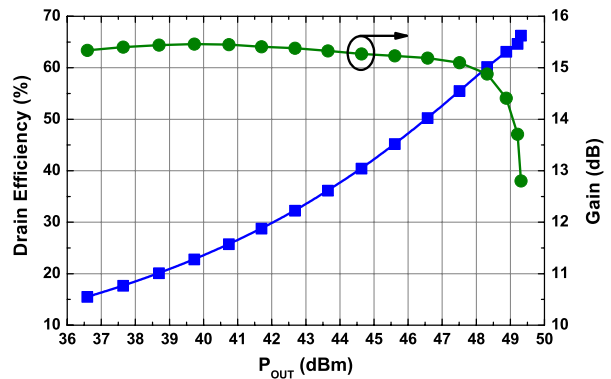
**Figure 5** - Typical CW Performance, over Frequency



**Figure 6** - Typical CW Performance over Frequency



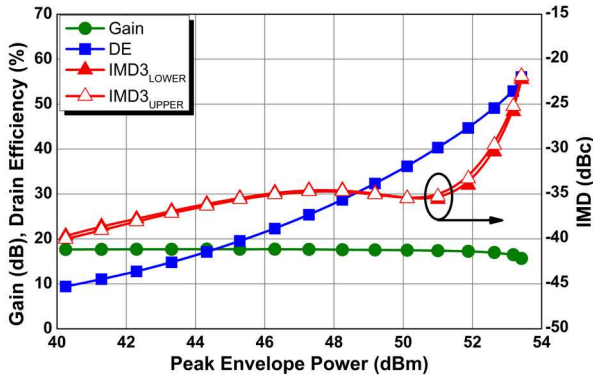
**Figure 7** - Typical Pulsed Performance, Frequency = 900MHz, Duty Cycle = 10%



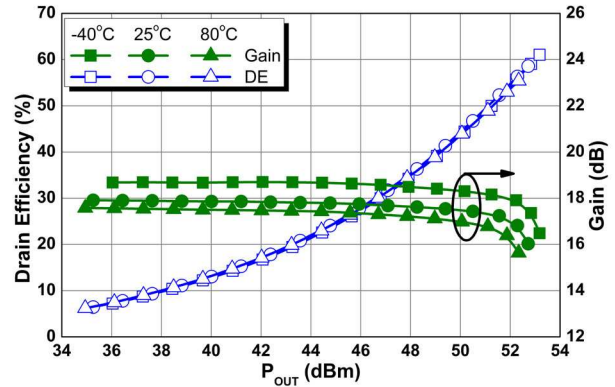
**Figure 8** - Typical CW Performance at  $V_{DS} = 20V$  Frequency = 900MHz

## Nitronex Quadrature Combined Test Fixture

$V_{DS}=28V$ ,  $I_{DQ}=1400mA$ ,  $T_A=25^\circ C$  unless otherwise noted.



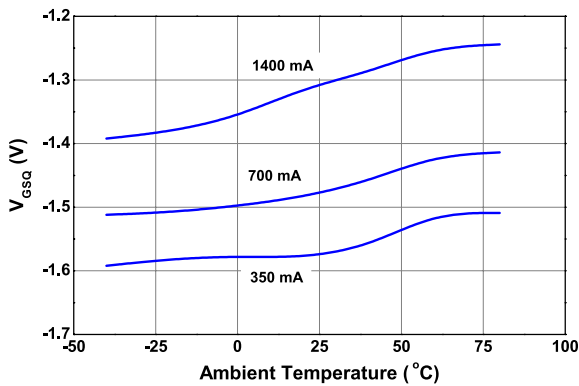
**Figure 9** - Typical IMD3 Performance, Frequency = 900MHz, Tone spacing = 1MHz



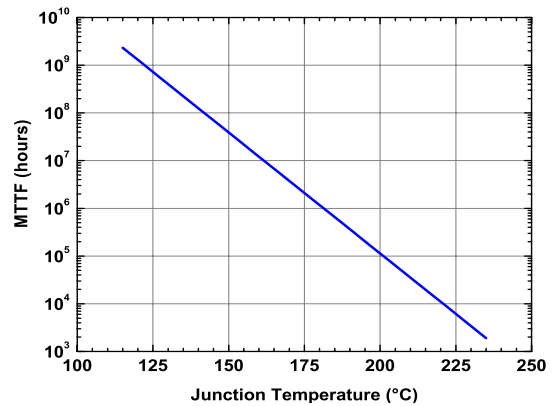
**Figure 10** - Typical CW Performance over Temperature, Frequency = 900MHz

## Typical Device Characteristics

$V_{DS}=28V$ ,  $I_{DQ}=700mA$ , One Single-Ended Transistor,  $T_A=25^\circ C$  unless otherwise noted.



**Figure 11** - Quiescent Gate Voltage ( $V_{GSQ}$ ) Required to Reach  $I_{DQ}$  over Temperature

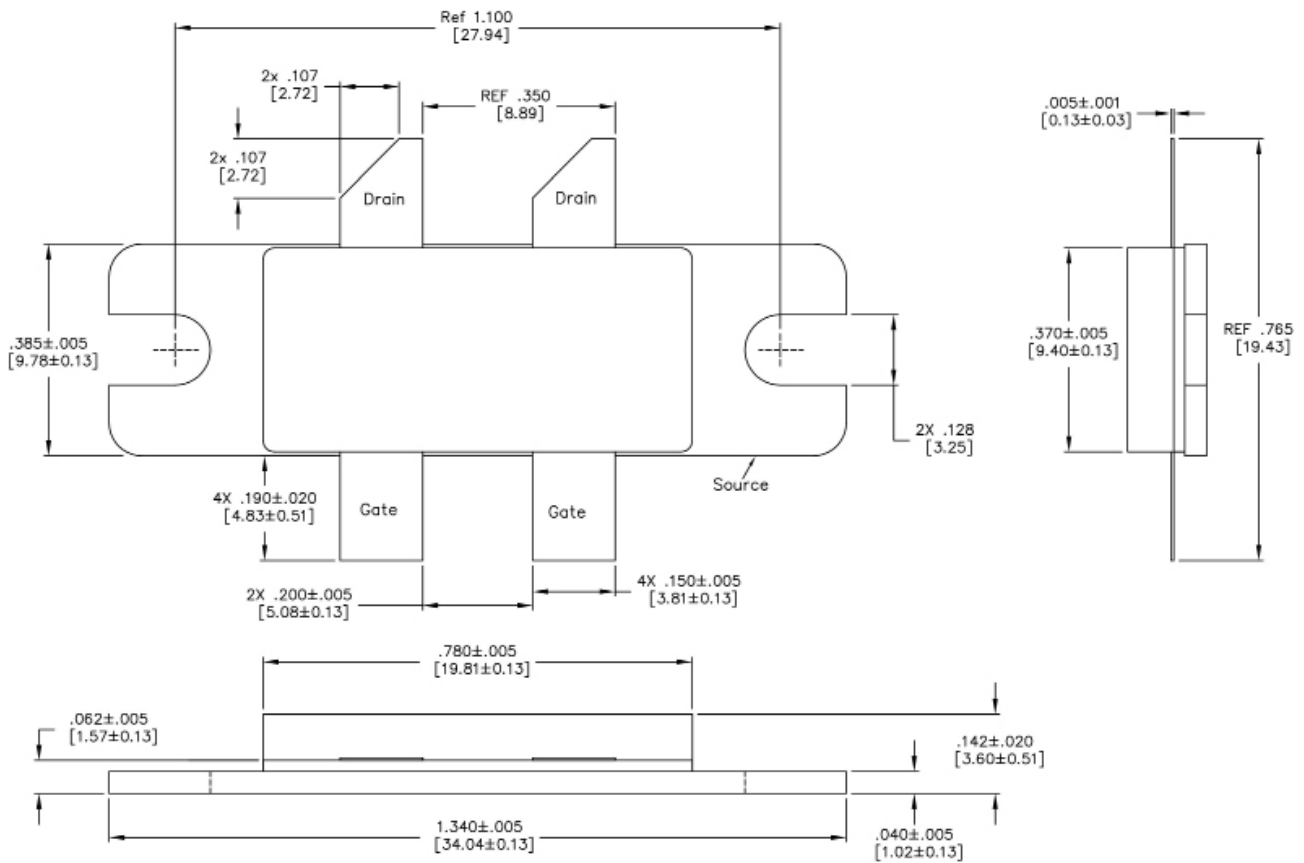


**Figure 12** - MTTF of NRF1 devices as a function of junction temperature

## Ordering Information<sup>1</sup>

Part Number	Description
NPT1007B	NPT1007 in AC780B-F4 Bolt-Down Package

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



**Figure 13 - AC780B-F4 Package Dimensions and Pinout (all dimensions are in inches)**

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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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