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## Gallium Nitride 28V, 45W RF Power Transistor

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

### FEATURES

- Optimized for pulsed, WiMAX, W-CDMA, LTE, and other light thermal load applications from DC to 4.0GHz
- 2500MHz performance
  - 45W P<sub>3dB</sub> CW power
  - 13.5 dB small signal gain
  - 55% efficiency at P<sub>3dB</sub>
- 100% RF tested
- Low cost, surface mount SOIC package
- High reliability gold metallization process
- Lead-free and RoHS compliant
- Subject to EAR99 Export Control



**DC - 4000MHz  
45 Watt, 28 Volt  
GaN HEMT**



**RF Specifications (2-Tone):** V<sub>DS</sub> = 28V, I<sub>DQ</sub> = 400mA, Frequency = 2500MHz, Tone Spacing = 1MHz, T<sub>C</sub> = 25°C, Measured in Nitronex Test Fixture

Symbol	Parameter	Min	Typ	Max	Units
P <sub>3dB</sub>	Average Output Power at 3dB Compression	35	45	-	W
P <sub>1dB</sub>	Average Output Power at 1dB Compression	-	28	-	W
G <sub>SS</sub>	Small Signal Gain	12.5	13.5	-	dB
η	Drain Efficiency at 3dB Gain Compression	50	55	-	%

**Typical OFDM Performance (2500-2700MHz):** V<sub>DS</sub> = 28V, I<sub>DQ</sub> = 350mA, P<sub>OUT,AVG</sub> = 37dBm, single carrier OFDM waveform 64-QAM 3/4, 8 burst, continuous frame data, 10 MHz channel bandwidth. Peak/Avg = 10.3dB @ 0.01% probability on CCDF. T<sub>C</sub> = 25°C. Measured in Load Pull System (Refer to Table 2 and Figure 1)

Symbol	Parameter	Typ	Units
EVM	Error Vector Magnitude	2.0	%
G <sub>P</sub>	Power Gain	13.0	dB
η	Drain Efficiency	27	%

**Typical OFDM Performance (3300-3500MHz):** V<sub>DS</sub> = 28V, I<sub>DQ</sub> = 350mA, P<sub>OUT,AVG</sub> = 36.5dBm, single carrier OFDM waveform 64-QAM 3/4, 8 burst, 20ms frame, 15ms frame data, 3.5 MHz channel bandwidth. Peak/Avg = 10.3dB @ 0.01% probability on CCDF. T<sub>C</sub> = 25°C. Measured in Load Pull System (Refer to Table 2 and Figure 1)

Symbol	Parameter	Typ	Units
EVM	Error Vector Magnitude	2.0	%
G <sub>P</sub>	Power Gain	10.5	dB
η	Drain Efficiency	25	%

## DC Specifications: $T_C=25^\circ\text{C}$

Symbol	Parameter	Min	Typ	Max	Units
<b>Off Characteristics</b>					
$V_{BDS}$	Drain-Source Breakdown Voltage ( $V_{GS} = -8\text{V}$ , $I_D = 16\text{mA}$ )	100	-	-	V
$I_{DLK}$	Drain-Source Leakage Current ( $V_{GS} = -8\text{V}$ , $V_{DS} = 60\text{V}$ )	-	2	10	mA
<b>On Characteristics</b>					
$V_T$	Gate Threshold Voltage ( $V_{DS} = 28\text{V}$ , $I_D = 16\text{mA}$ )	-2.3	-1.8	-1.3	V
$V_{GSQ}$	Gate Quiescent Voltage ( $V_{DS} = 28\text{V}$ , $I_D = 350\text{mA}$ )	-2.0	-1.5	-1.0	V
$R_{ON}$	On Resistance ( $V_{GS} = 2\text{V}$ , $I_D = 120\text{mA}$ )	-	0.25	0.30	$\Omega$
$I_D$	Drain Current ( $V_{DS} = 7\text{V}$ pulsed, 300ms pulse width, 0.2% duty cycle, $V_{GS} = 2\text{V}$ )	7.5	9.5	-	A

## Absolute Maximum Ratings: Not simultaneous, $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Max	Units
$V_{DS}$	Drain-Source Voltage	100	V
$V_{GS}$	Gate-Source Voltage	-10 to 3	V
$P_T$	Total Device Power Dissipation (Derated above $25^\circ\text{C}$ )	40	W
$\theta_{JC}$	Thermal Resistance (Junction-to-Case)	4.3	$^\circ\text{C}/\text{W}$
$T_{STG}$	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)	1B (>500V)	
MM	Machine Model ESD Rating (per JESD22-A113)	M1(>50V)	
MSL	Moisture Sensitivity Level (per IPC/JEDEC J-STD-020): Rating of 3 at $260^\circ\text{C}$ Package Peak Temperature		



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

$V_{DS}=28V$ ,  $I_{DQ}=350mA$ ,  $T_A=25^\circ C$  unless otherwise noted

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

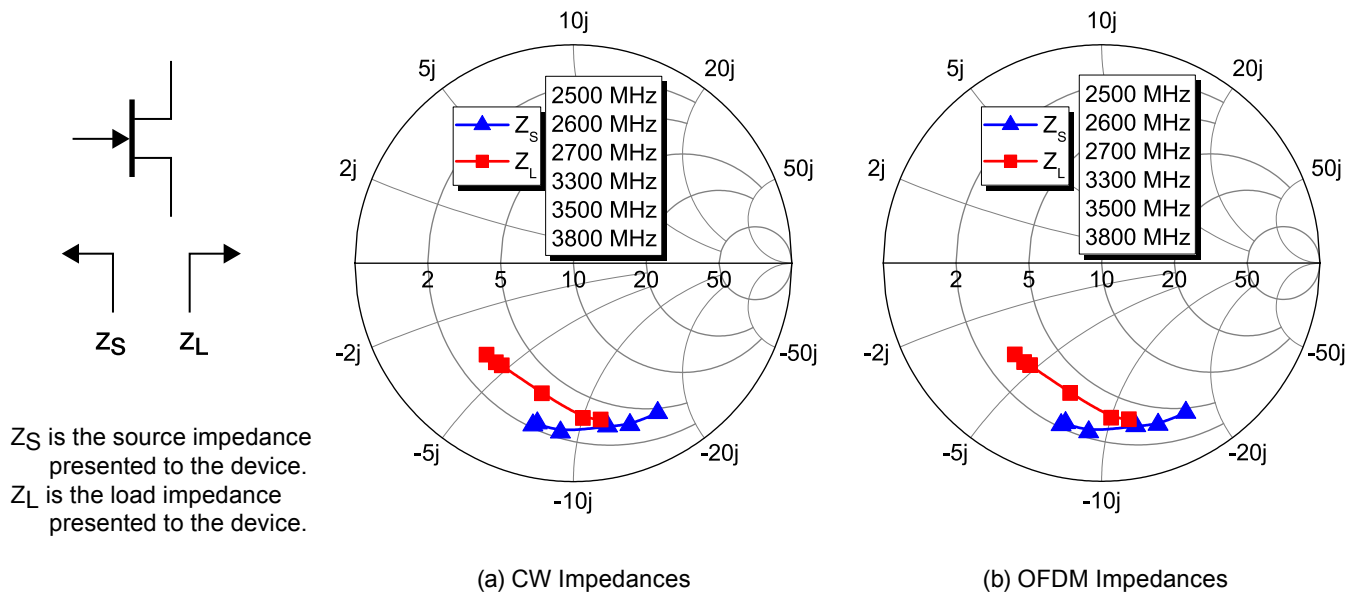
Frequency (MHz)	$Z_S (\Omega)$	$Z_L (\Omega)$	$P_{SAT} (W)$	$G_{SS} (dB)$	Drain Efficiency @ $P_{SAT}$ (%)
900	$2.0 + j2.7$	$6.0 + j3.3$	45	22.5	72
1500	$1.6 - j0.8$	$4.5 + j0.5$	45	18.5	70
2500	$2.0 - j3.2$	$3.5 - j5.0$	45	14.0	65
3500	$3.2 - j6.5$	$2.9 - j8.0$	35	12.0	60

**Table 2:** Optimum Source and Load Impedances for WiMAX Gain, Drain Efficiency, Output Power, and Linearity Performance

Frequency (MHz)	$Z_S (\Omega)$	$Z_L (\Omega)$	$P_{OUT} (W)$	Gain (dB)	Drain Efficiency (%)
2500 <sup>1</sup>	$2.1 - j7.6$	$3.1 - j3.9$	5	14.0	27
2600 <sup>1</sup>	$2.3 - j7.7$	$3.3 - j4.4$	5	13.0	27
2700 <sup>1</sup>	$2.3 - j9.0$	$3.4 - j4.7$	5	13.0	27
3300 <sup>2</sup>	$3.3 - j11.8$	$3.7 - j7.2$	6.3	11.5	30
3500 <sup>2</sup>	$3.5 - j13.5$	$3.5 - j10.0$	4.5	10.5	25
3800 <sup>2</sup>	$4.5 - j16.2$	$3.7 - j11.2$	3.2	8.0	17

Note 1: Single carrier OFDM waveform 64-QAM 3/4, 8 burst, continuous frame data, 10 MHz channel bandwidth.  
Peak/Avg = 10.3dB @ 0.01% probability on CCDF, 2% EVM.

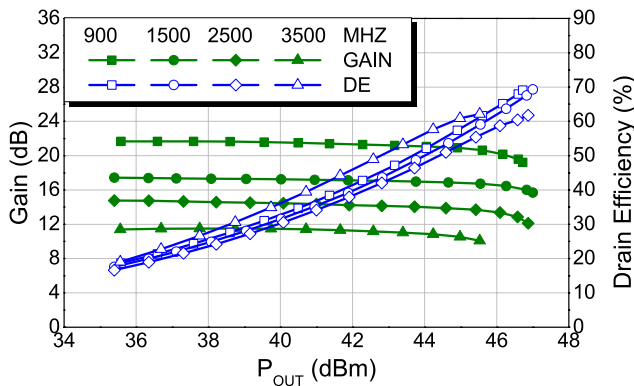
Note 2: Single carrier OFDM waveform 64-QAM 3/4, 8 burst, 20ms frame, 15ms frame data, 3.5 MHz channel bandwidth.  
Peak/Avg = 10.3dB @ 0.01% probability on CCDF, 2% EVM.



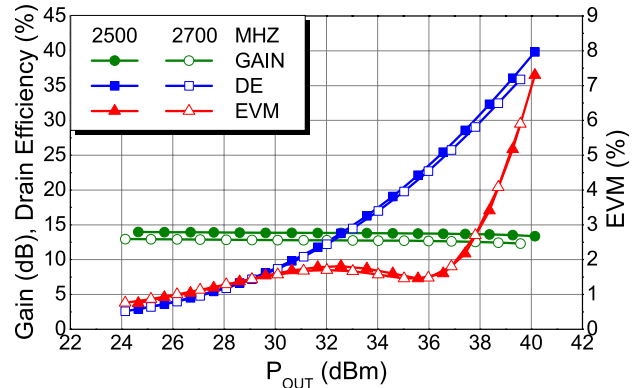
**Figure 1 - Optimal Impedances for CW and OFDM Performance**

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

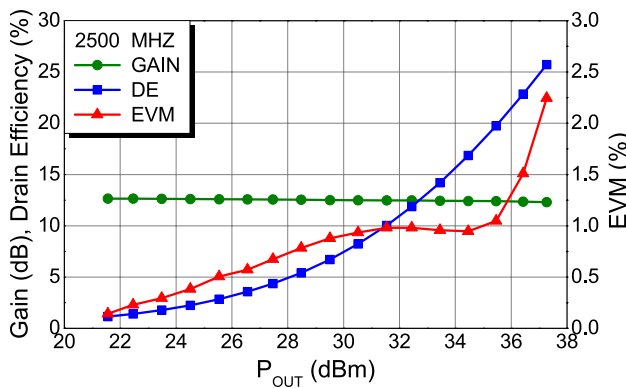
$V_{DS}=28V$ ,  $I_{DQ}=350mA$ ,  $T_A=25^\circ C$  unless otherwise noted.



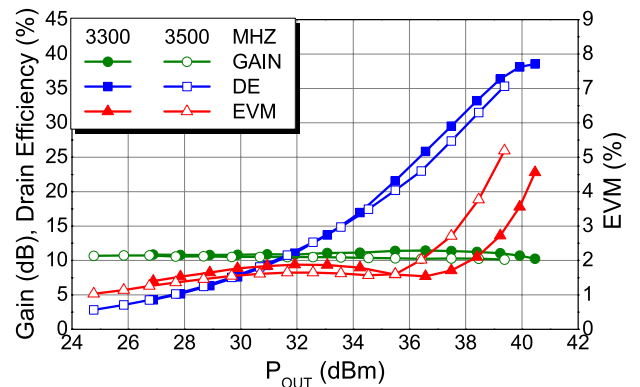
**Figure 2** - Typical CW Performance, Frequency = 900 to 3500MHz,  $I_{DQ}=400mA$



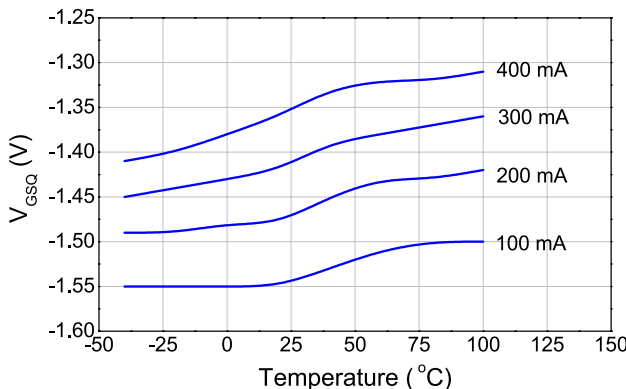
**Figure 3** - OFDM Performance Tuned for  $P_{OUT}$  at 2% EVM in Load-Pull System



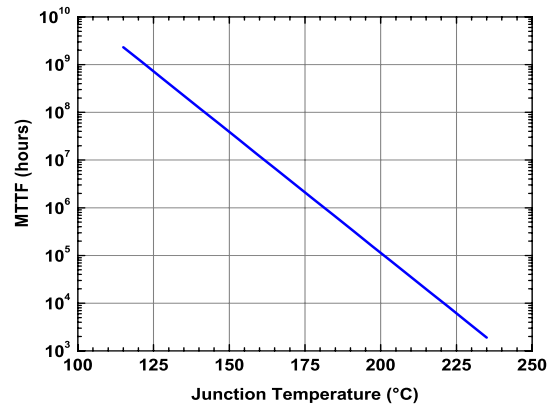
**Figure 4** - OFDM Performance Tuned for  $P_{OUT}$  at 1.5% EVM in Load-Pull System



**Figure 5** - OFDM Performance Tuned for  $P_{OUT}$  at 2% EVM in Load-Pull System



**Figure 6** - Quiescent Gate Voltage ( $V_{GSQ}$ ) Required to Reach  $I_{DQ}$  as a Function of Case Temperature



**Figure 7** - MTTF of NRF1 devices as a function of junction temperature

# NPT1004

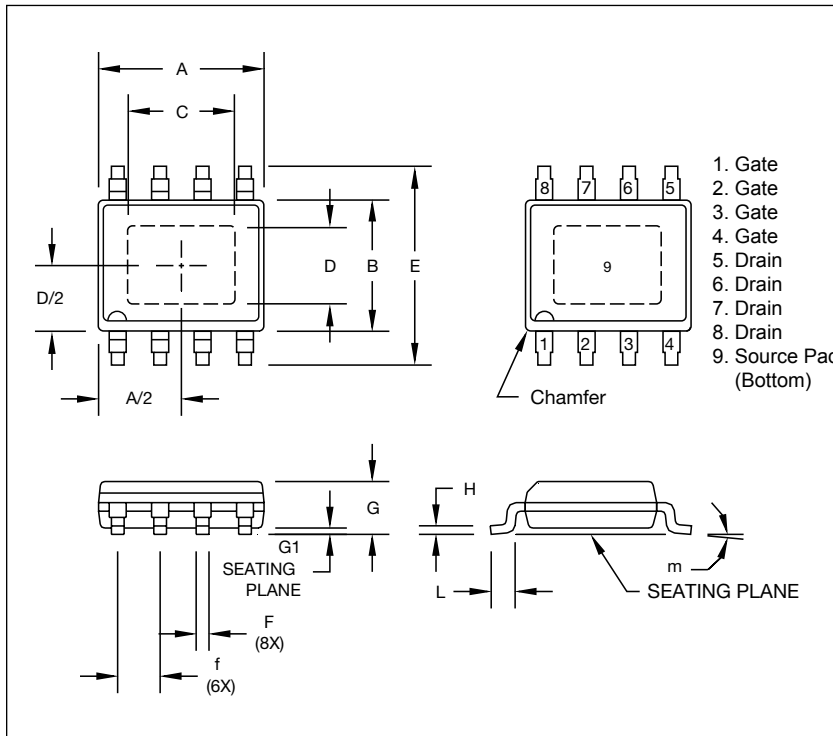


## Ordering Information

Part Number	Order Multiple	Description
NPT1004DT	97	Tube; NPT1004 in D (PSOP2) Package
NPT1004DR	1500	Tape and Reel; NPT1004 in D (PSOP2) Package

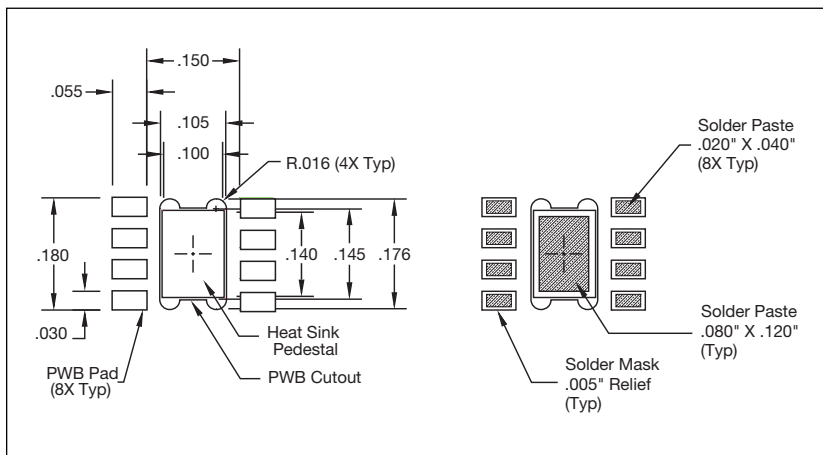
1: To find a Nitronex contact in your area, visit our website at <http://www.nitronex.com>

## D Package Dimensions and Pinout



Dim	Inches		Millimeters	
	Min	Max	Min	Max
A	0.189	0.196	4.80	4.98
B	0.150	0.157	3.81	3.99
C	0.107	0.123	2.72	3.12
D	0.071	0.870	1.80	2.21
E	0.230	0.244	5.84	6.22
f	0.50 BSC		1.270 BSC	
F	0.0138	0.0192	0.35	0.49
G	0.055	0.065	1.40	1.65
G1	0.000	0.004	0.00	0.10
H	0.0075	0.0098	0.19	0.25
L	0.016	0.035	0.40	0.89
m	0°	8°	0°	8°

## Mounting Footprints



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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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