

## 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 narrowband power
- 10W  $P_{3dB}$  CW broadband power from 500-1000MHz
- Characterized for operation up to 32V
- 100% RF tested
- Thermally enhanced industry standard package
- High reliability gold metallization process
- Lead-free and RoHS compliant
- Subject to EAR99 export control



**Broadband  
25 Watt, 28 Volt  
GaN HEMT**



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

| Symbol    | Parameter                                                                  | Min                                   | Typ  | Max | Units |
|-----------|----------------------------------------------------------------------------|---------------------------------------|------|-----|-------|
| $P_{3dB}$ | Average Output Power at 3dB Gain Compression                               | 22                                    | 25   | -   | W     |
| $P_{1dB}$ | Average Output Power at 1dB Gain Compression                               | 18                                    | 21   | -   | W     |
| $G_{SS}$  | Small Signal Gain                                                          | 12.5                                  | 13.5 | -   | dB    |
| $\eta$    | Drain Efficiency at 3dB Gain Compression                                   | 60                                    | 65   | -   | %     |
| $\psi$    | Output mismatch stress, VSWR = 10:1, all phase angles, $P_{OUT} = P_{SAT}$ | No Performance Degradation After Test |      |     |       |

**Absolute Maximum Ratings:** Not simultaneous,  $T_C = 25^{\circ}C$  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 $25^{\circ}C$ ) | 33         | W             |
| $\theta_{JC}$ | Thermal Resistance (Junction-to-Case)                         | 5.25       | $^{\circ}C/W$ |
| $T_{STG}$     | Storage Temperature Range                                     | -65 to 150 | $^{\circ}C$   |
| $T_J$         | Operating Junction Temperature                                | 200        | $^{\circ}C$   |
| HBM           | Human Body Model ESD Rating (per JESD22-A114)                 | 1A (>250V) |               |
| MM            | Machine Model ESD Rating (per JESD22-A115)                    | M1 (>50V)  |               |

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

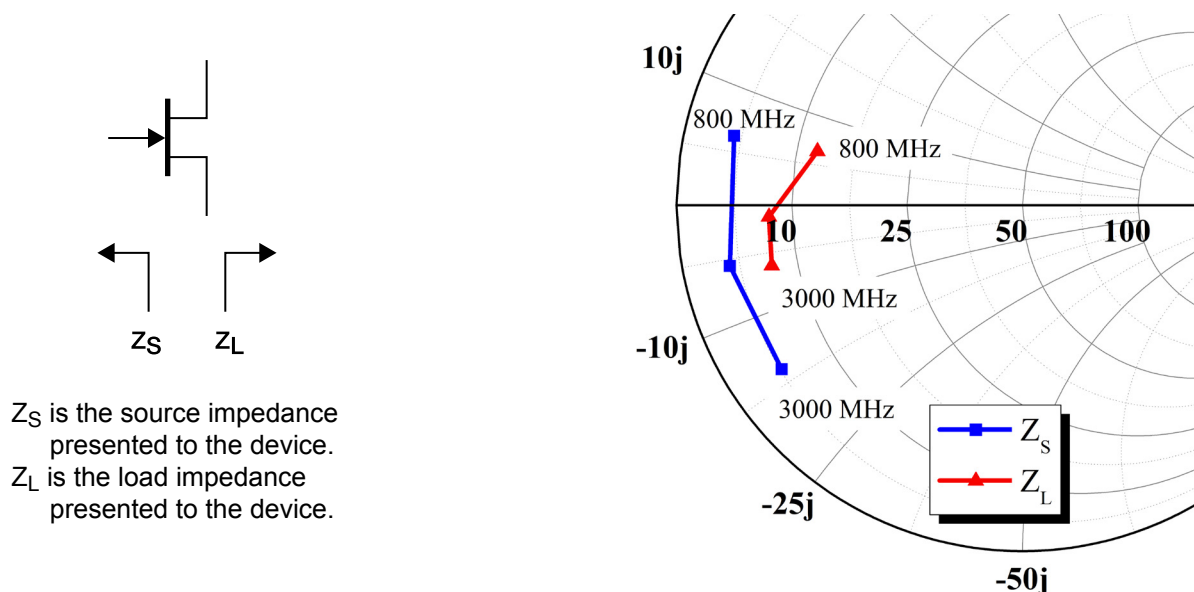
| Symbol                     | Parameter                                                                                                                  | Min  | Typ  | Max  | Units    |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------|------|------|------|----------|
| <b>Off Characteristics</b> |                                                                                                                            |      |      |      |          |
| $V_{BDS}$                  | Drain-Source Breakdown Voltage<br>( $V_{GS} = -8\text{V}$ , $I_D = 8\text{mA}$ )                                           | 100  | -    | -    | V        |
| $I_{DLK}$                  | Drain-Source Leakage Current<br>( $V_{GS} = -8\text{V}$ , $V_{DS} = 60\text{V}$ )                                          | -    | 1    | 5    | mA       |
| <b>On Characteristics</b>  |                                                                                                                            |      |      |      |          |
| $V_T$                      | Gate Threshold Voltage<br>( $V_{DS} = 28\text{V}$ , $I_D = 8\text{mA}$ )                                                   | -2.3 | -1.8 | -1.3 | V        |
| $V_{GSQ}$                  | Gate Quiescent Voltage<br>( $V_{DS} = 28\text{V}$ , $I_D = 225\text{mA}$ )                                                 | -2.0 | -1.5 | -1.0 | V        |
| $R_{ON}$                   | On Resistance<br>( $V_{GS} = 2.0\text{V}$ , $I_D = 60\text{mA}$ )                                                          | -    | 0.44 | 0.55 | $\Omega$ |
| $I_D$                      | Drain Current<br>( $V_{DS} = 7\text{V}$ pulsed, $300\mu\text{s}$ pulse width,<br>0.2% duty cycle, $V_{GS} = 2.0\text{V}$ ) | 4.9  | 5.4  | -    | A        |

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

$V_{DS}=28\text{V}$ ,  $I_{DQ}=225\text{mA}$ ,  $T_A=25^\circ\text{C}$  unless otherwise noted

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

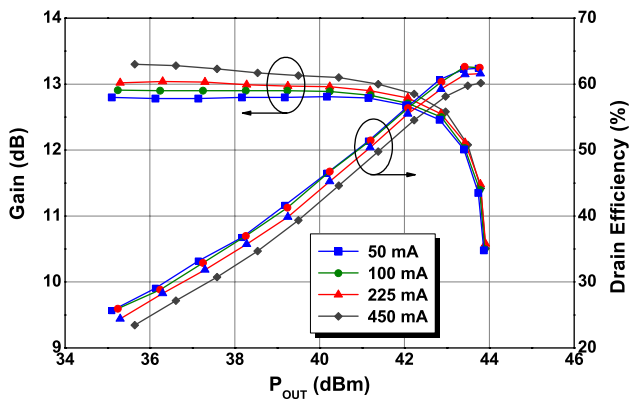
| Frequency (MHz) | $Z_S (\Omega)$ | $Z_L (\Omega)$ |
|-----------------|----------------|----------------|
| 800             | $3.9 + j5.9$   | $12.2 + j6.1$  |
| 2000            | $3.7 - j5.1$   | $7.7 - j1.1$   |
| 3000            | $4.7 - j15.3$  | $7.4 - j5.8$   |



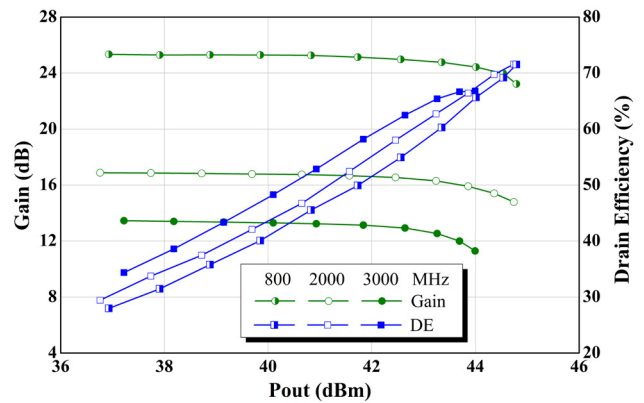
**Figure 1** - Optimal Impedances for CW Performance,  $V_{DS} = 28\text{V}$ ,  $I_{DQ} = 225\text{mA}$

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

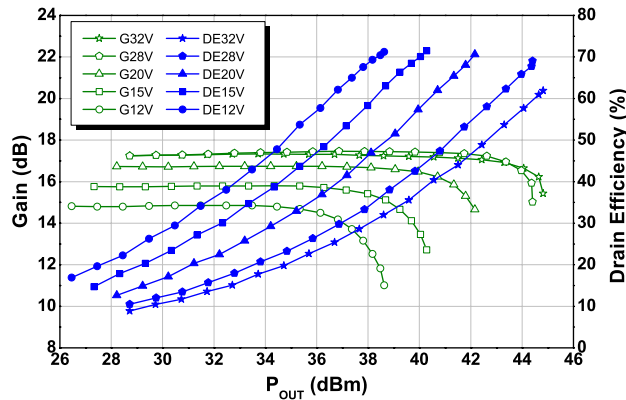
$V_{DS}=28V$ ,  $I_{DQ}=225mA$ ,  $T_A=25^{\circ}C$  unless otherwise noted.



**Figure 2** - Typical CW Performance, Over Current, Frequency = 3000MHz



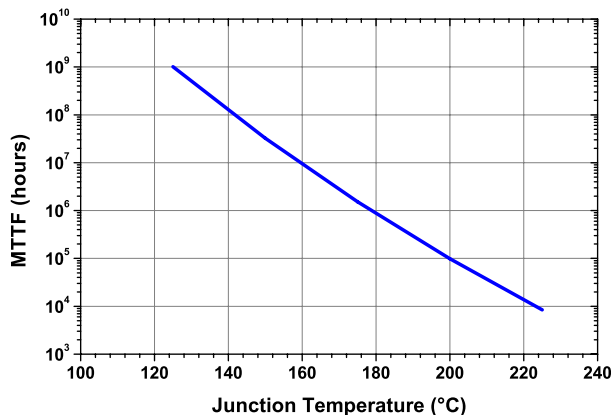
**Figure 3** - Typical CW Performance Over Frequency



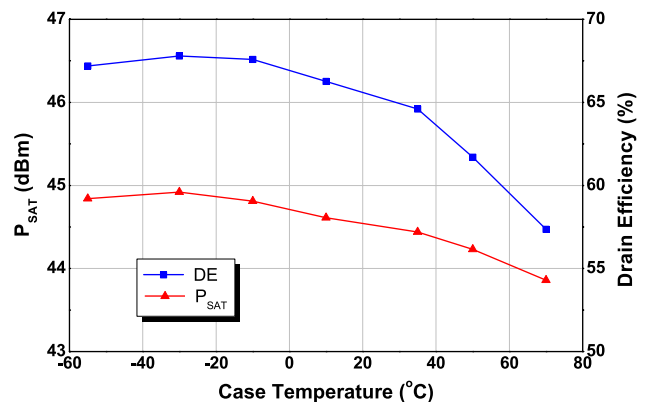
**Figure 4** - Typical CW Performance Over Voltage, Impedances Held Constant, Frequency = 1800MHz

## Typical Device Characteristics

$V_{DS}=28V$ ,  $I_{DQ}=225mA$ ,  $T_A=25^{\circ}C$  unless otherwise noted.



**Figure 5** - MTTF of NRF1 Devices as a Function of Junction Temperature



**Figure 6** - Typical CW Performance in Nitronex Test Fixture, Frequency = 3000MHz

## NPTB00025, 3000MHz CW Production Test Fixture

$V_{DS}=28V$ ,  $I_{DQ}=225mA$ ,  $T_A=25^{\circ}C$  unless otherwise noted. Additional design information and data available at [www.nitronex.com](http://www.nitronex.com).

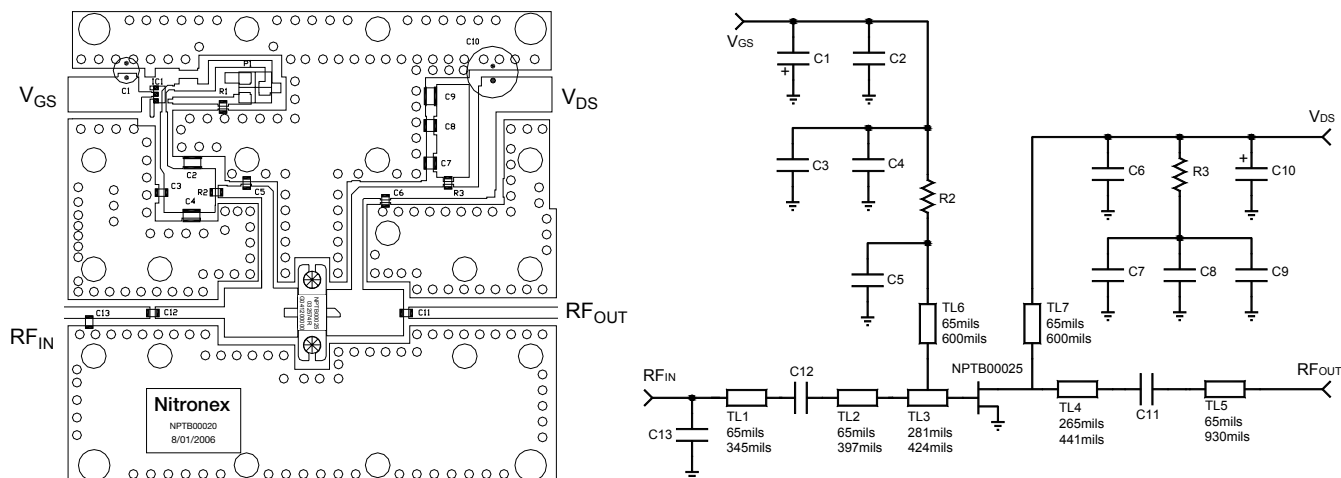


Figure 7 - NPTB00025 3000MHz Test Fixture

Table 2: NPTB00025 3000MHz Test Fixture Bill of Materials

| Name             | Value    | Vendor          | Part Number                     |
|------------------|----------|-----------------|---------------------------------|
| C1               | 150uF    | Nichicon        | UPW1C151MED                     |
| C10              | 270uF    | United Chmi-Con | ELXY630ELL271MK25S              |
| C2, C8           | 0.1uF    | Kemet           | C1206C104K1RACTU                |
| C3, C7           | 0.01uF   | AVX             | 12061C103KAT2A                  |
| C4, C9           | 1.0 uF   | Panasonic       | ECJ-5YB2A105M                   |
| C5, C6, C11, C12 | 5.6pF    | ATC             | ATC600F5R6CT                    |
| C13              | 1.2pF    | ATC             | ATC600F1R2AT                    |
| R2               | 49.9 ohm | Panasonic       | ERJ-6ENF49R9V                   |
| R3               | 0.33 ohm | Panasonic       | ERJ-6RQFR33V                    |
| Substrate        | -        | Taconic         | RF35, t=30mil, $\epsilon_r=3.5$ |

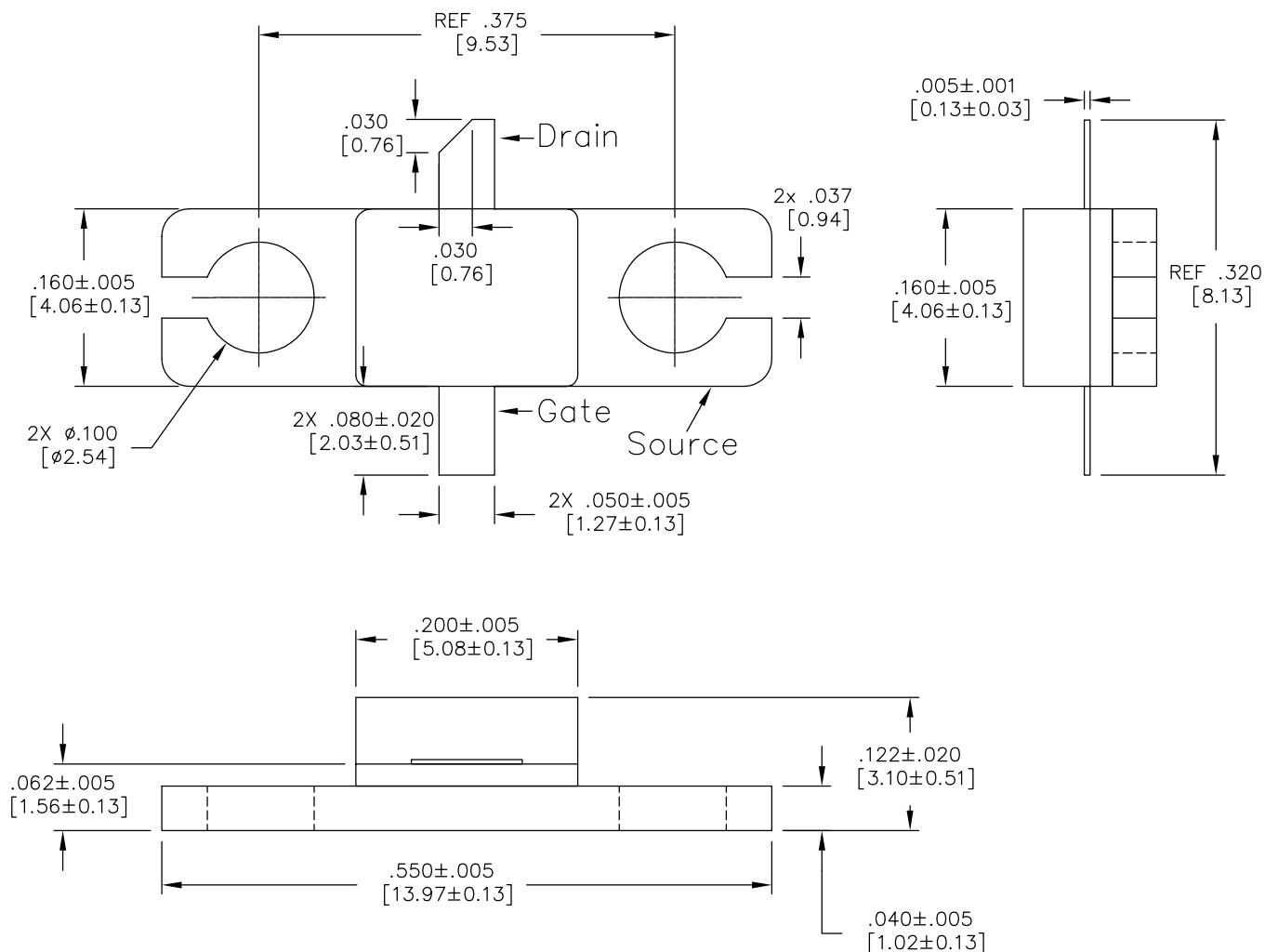
# NPTB00025



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

| Part Number | Description                                           |
|-------------|-------------------------------------------------------|
| NPTB00025B  | NPTB00025 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>



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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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