Features

- Optimized for Broadband Operation (DC - 4 GHz)
- 25 W P3dB CW Narrowband Power
- 10 W P3dB CW Broadband Power (0.05 - 1 GHz)
- Characterized for Operation up to 32 V
- 100% RF Tested
- Thermally-Enhanced Surface Mount Package
- High Reliability Gold Metallization Process
- Subject to EAR99 Export Control
- RoHS* Compliant

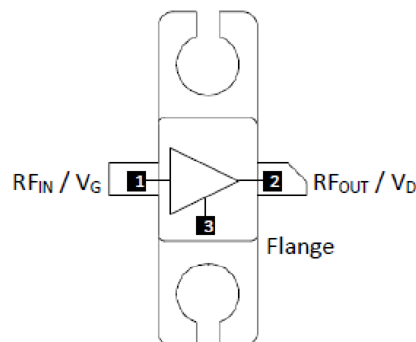
Applications

- Defense Communications
- Land Mobile Radio
- Avionics
- Wireless Infrastructure
- ISM
- VHF/UHF/L/S-Band Radar

Description

The NPTB00025 GaN HEMT is a power transistor optimized for DC - 4 GHz operation. This device supports CW, pulsed, and linear operation with output power levels to 25 W. This transistor is assembled in an industry standard surface mount plastic package.

Functional Schematic



Pin Configuration

Pin #	Pin Name	Function
1	RF_{IN} / V_G	RF Input / Gate
2	RF_{OUT} / V_D	RF Output / Drain
3	Flange[1]	Ground / Source

1. The Flange must be connected to RF and DC ground. This path must also provide a low thermal resistance heat path.

Ordering Information

Part Number	Package
NPTB00025B	30 slot tray

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

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DC-0008203

Typical CW RF Specifications: (measured in a test fixture)
Freq. = 3 GHz, V_{DS} = 28 V, I_{DQ} = 225 mA, T_C = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Average Output Power	3 dB Compression 1 dB Compression	P_{3dB} P_{1dB}	22 18	25 21	—	W
Small Signal Gain	—	G_{SS}	12.5	13.5	—	dB
Drain Efficiency	3 dB Compression	η	60	65	—	%
Output Mismatch Stress	VSWR = 10:1. all phase angles, P_{OUT} = P_{SAT}	Ψ	No performance degradation after test			

DC Electrical Characteristics: T_C = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Off Characteristics						
Drain-Source Breakdown Voltage	V_{GS} = -8 V, I_D = 8 mA	V_{BDS}	100	—	—	V
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 60 V	I_{DLK}	—	1	5	mA
On Characteristics						
Gate Threshold Voltage	V_{DS} = 28 V, I_D = 8 mA	V_T	-2.3	-1.8	-1.3	V
Gate Quiescent Voltage	V_{DS} = 28 V, I_D = 225 mA	V_{GSQ}	-2.0	-1.5	-1.0	V
On Resistance	V_{GS} = 2 V, I_D = 60 mA	R_{ON}	—	0.44	0.55	Ω
Drain Current	V_{DS} = 7 V pulsed, pulse width 300 μs 0.2% Duty Cycle, V_{GS} = 2 V	I_D	4.9	5.4	—	A

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

Gallium Nitride Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM Class 1A devices.

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Absolute Maximum Ratings[2,3,4]

Parameter	Absolute Maximum
Drain Source Voltage, V_{DS}	100 V
Gate Source Voltage, V_{GS}	-10 to 3 V
Gate Current, I_G	40 mA
Total Device Power Dissipation (derated above +25°C)	33 W
Junction Temperature, T_J	+200°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

2. Exceeding any one or combination of these limits may cause permanent damage to this device.
3. MACOM does not recommend sustained operation near these survivability limits.
4. Operating at nominal conditions with $T_J \leq 200°C$ will ensure MTTF > 1×10^6 hours.

Thermal Characteristics[5]

Parameter	Test Conditions	Symbol	Typical	Units
Thermal Resistance	V_{DS} = 28 V, T_J = 200°C	$R_{\theta JC}$	5.25	°C/W

5. Junction temperature (T_J) measured using IR Microscopy. Case temperature measured using thermocouple embedded in heat-sink.

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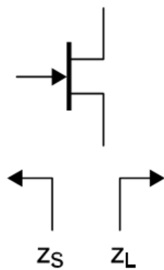
Load-Pull Data, Reference Plane at Device Leads: V_{DS} = 28 V, I_{DQ} = 225 mA, T_C = 25°C

Table 1: Optimum Impedance Characteristics for CW Gain, Drain Efficiency, and Output Power Performance

Frequency (MHz)	Z_S (Ω)	Z_L (Ω)
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

Impedance Reference



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

Z_S and Z_L vs. Frequency

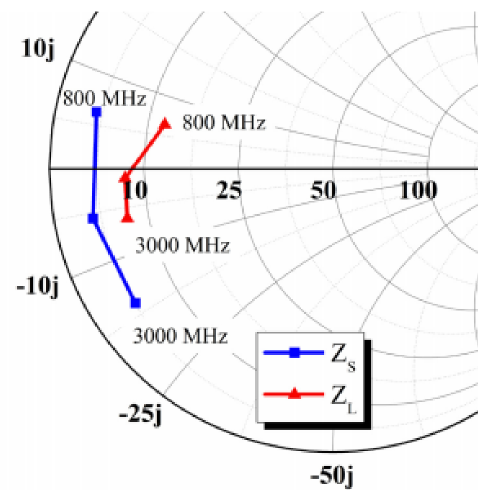


Figure 1 - Optimum Impedance Characteristics for CW Performance, V_{DS} = 28 V, I_{DQ} = 225 mA

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Load-Pull Data, Reference Plane at Device Leads: V_{DS} = 28 V, I_{DQ} = 225 mA, T_A = 25°C

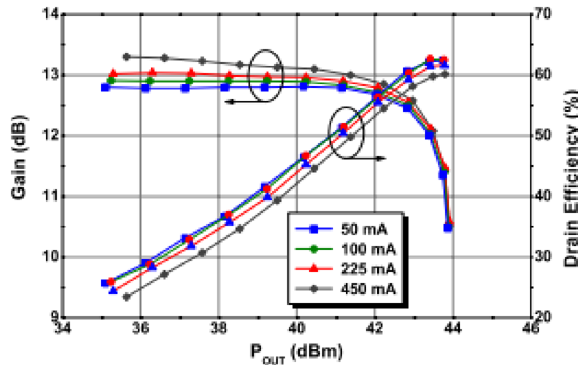

Figure 2 - Typical CW Performance, Over Current, Frequency = 3000 MHz

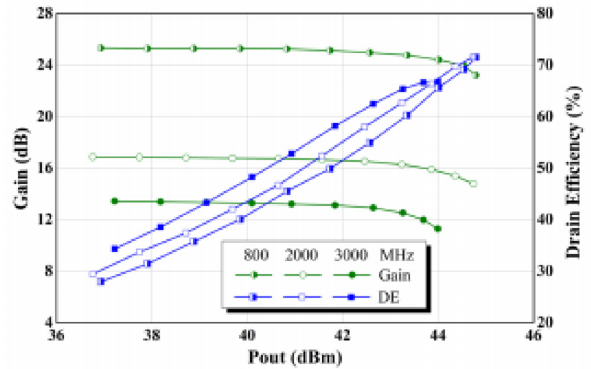

Figure 3 - Typical CW Performance, Over Frequency

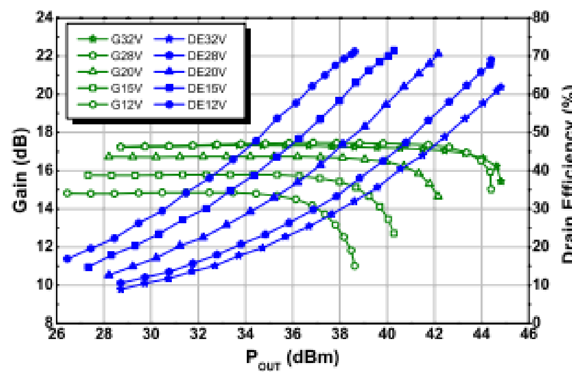

Figure 4 - Typical CW Performance Over Voltage, Impedances Held Constant, Frequency = 1800 MHz

Typical Device Characteristics: V_{DS} = 28 V, I_{DQ} = 225 mA, T_A = 25°C

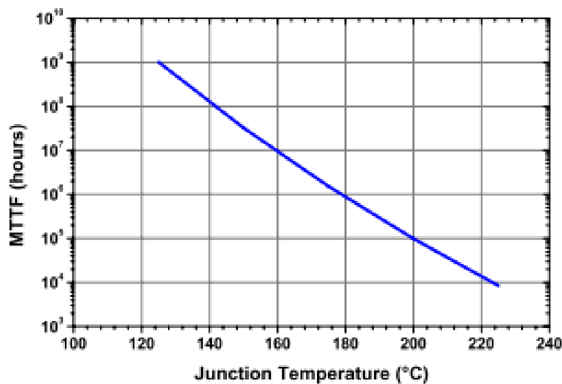

Figure 5 - MTTF of NRF1 Devices as a Function of Junction Temperature

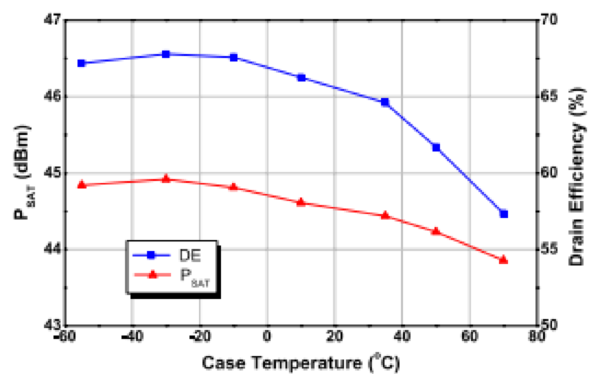

Figure 6 - Typical CW Performance in test fixture, Frequency = 3000 MHz

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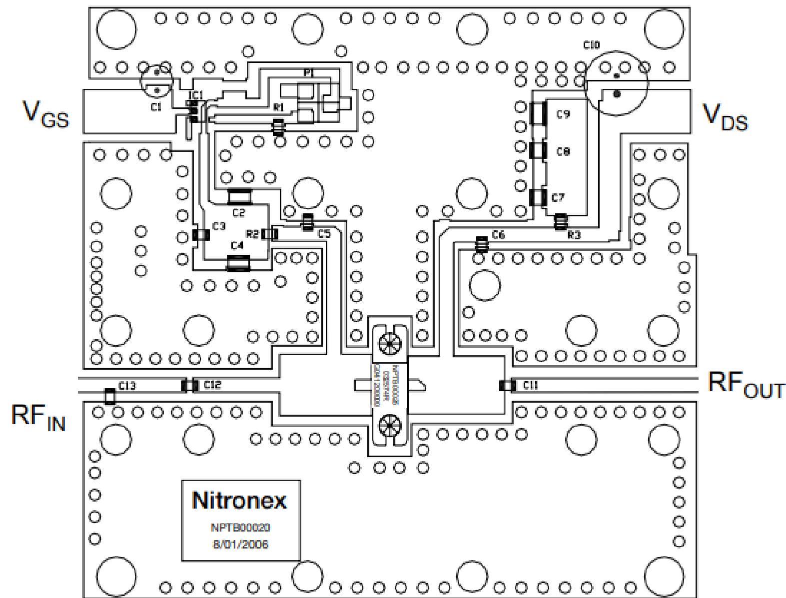
NPTB00025 3000 MHz, CW Production Test Fixture

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



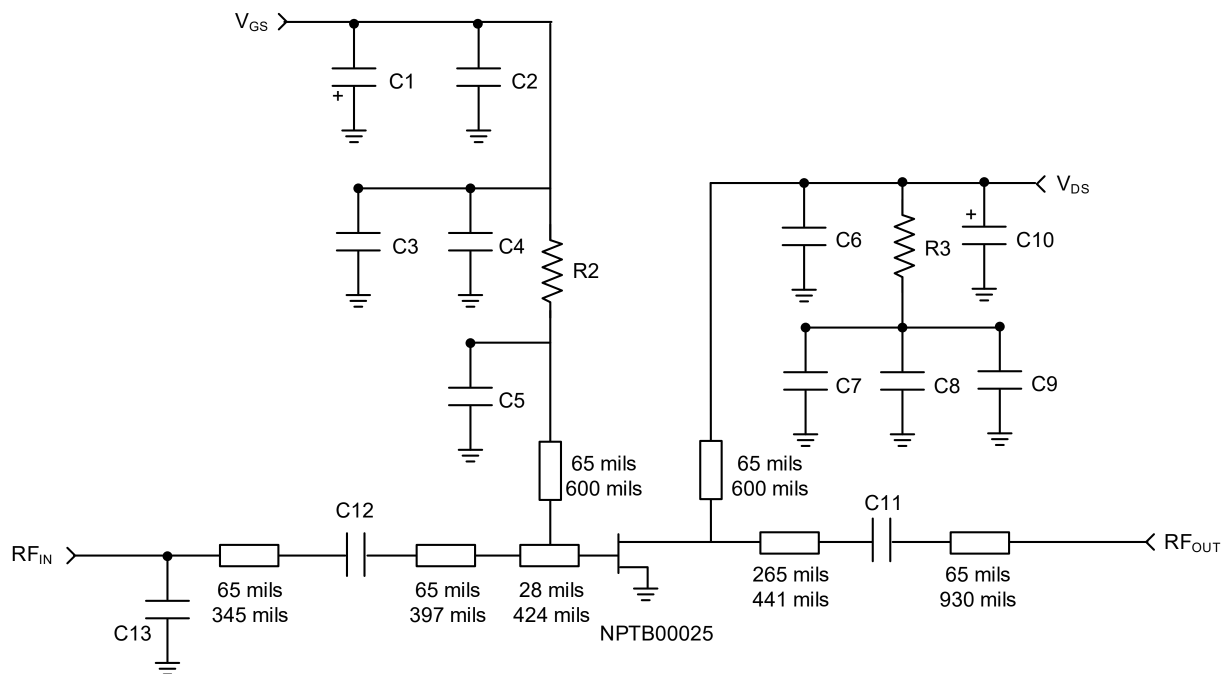


Figure 7 - NPTB00025 3000 MHz Test Fixture and Schematic

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Parts list

Reference	Value	Tolerance	Manufacturer	Part Number
C1	150 µF	20%	Nichicon	UPW1C151MED
C10	270 µF	20%	United Chemi-Con	ELXY630ELL271MK25S
C2, C8	0.1 µF	10%	Kemet	C1206C104K1RACTU
C3, C7	0.01 µF	10%	AVX	12061C103KAT2A
C4, C9	1 µF	10%	Panasonic	ECJ-5YB2A105M
C5, C6, C11, C12	5.6 pF	±0.1 pF	ATC	ATC600F5R6B
C13	1.2 pF	±0.1 pF	ATC	ATC600F1R2AT
R2	49.9 Ω	1%	Panasonic	ERJ-6ENF49R9V
R3	0.33 Ω	1%	Panasonic	ERJ-6RQFR33V
PCB	Taconic, RF35, ε_r=3.5, t = 30 mils			

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Outline Drawing

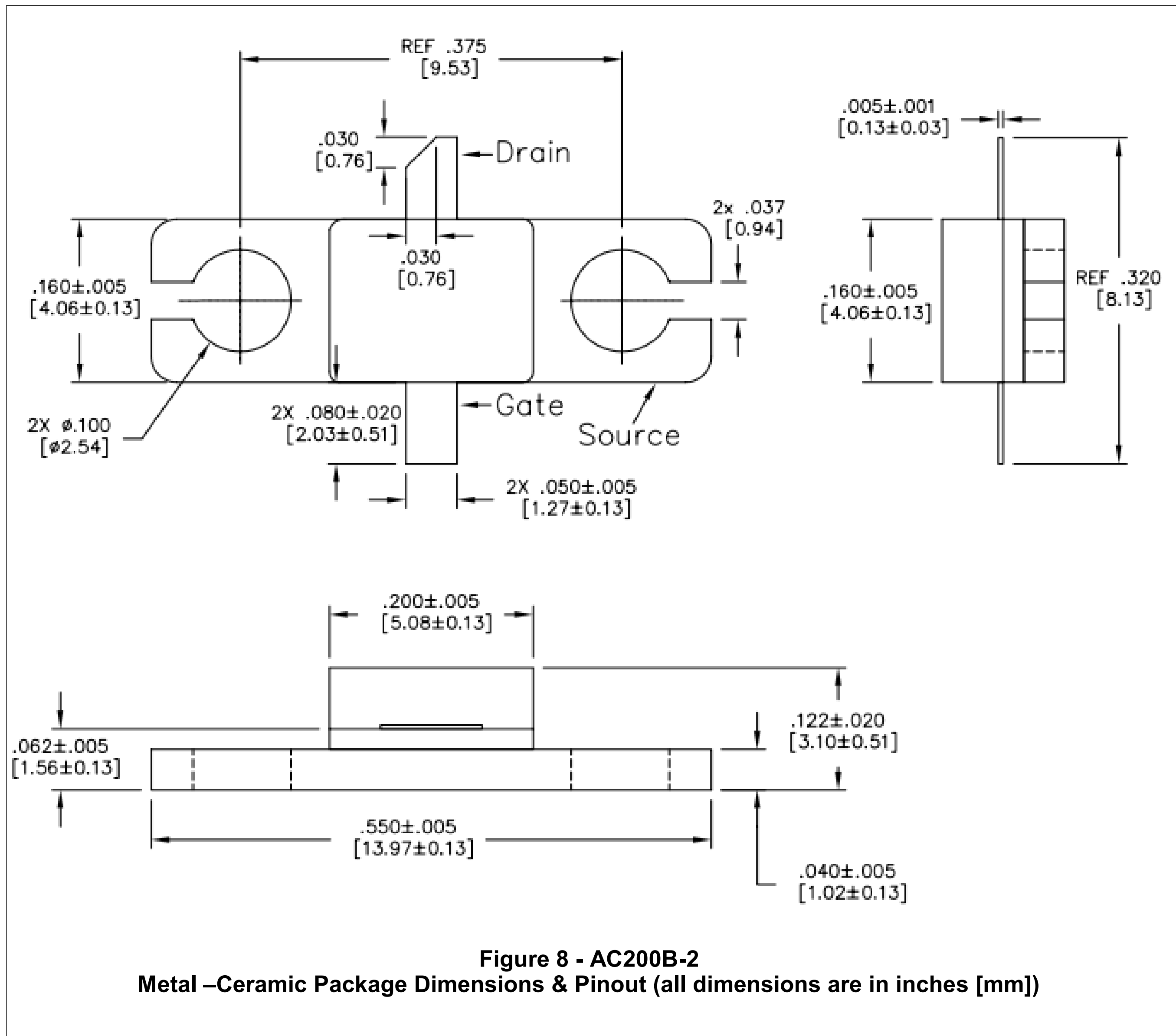

Figure 8 - AC200B-2
Metal –Ceramic Package Dimensions & Pinout (all dimensions are in inches [mm])

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