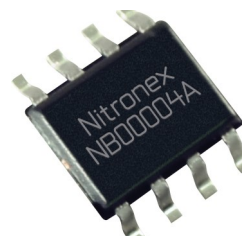


Gallium Nitride 28V, 5W, DC-6 GHz HEMT

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

Features

- Broadband operation from DC-6 GHz
- 28V Operation
- Industry Standard Plastic Package
- High Drain Efficiency (>55%)
- Drop in Replacement for NPTB00004



Applications

- Broadband General Purpose
- Defense Communications
- Land Mobile Radio
- Wireless Infrastructure
- ISM Applications
- VHF/UHF/L-Band Radar

DC-6 GHz
5W
GaN HEMT



Product Description

The NPTB00004A GaN HEMT is a wideband transistor optimized for DC-6 GHz operation. This device has been designed for CW, pulsed, and linear operation with output power levels to 5W (37 dBm) in an industry standard surface mount SOIC plastic package. At frequencies below 3GHz, the NPTB00004A is a drop in replacement for the NPTB00004.

RF Specifications (CW, 2.5 GHz): $V_{DS} = 28V$, $I_{DQ} = 50mA$, $T_C = 25^{\circ}C$

Symbol	Parameter	Min	Typ	Max	Units
G_{SS}	Small-signal Gain	-	16	-	dB
P_{SAT}	Saturated Output Power	-	37.1	-	dBm
η_{SAT}	Efficiency at Saturated Output Power	-	63.7	-	%
G_P	Gain at $P_{OUT} = 4W$	12.8	14.8	-	dB
η	Drain Efficiency at $P_{OUT} = 4W$	45	57	-	%
V_{DS}	Drain Voltage	-	28	-	V
Ψ	Ruggedness: Output Mismatch, all phase angles	VSWR = 15:1, No Device Damage			

NPTB00004A



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

Symbol	Parameter	Min	Typ	Max	Units
Off Characteristics					
I_{DLK}	Drain-Source Leakage Current ($V_{GS}=-8\text{V}$, $V_{DS}=100\text{V}$)	-	-	2	mA
I_{GLK}	Gate-Source Leakage Current ($V_{GS}=-8\text{V}$, $V_{DS}=0\text{V}$)	-	-	1	mA
On Characteristics					
V_T	Gate Threshold Voltage ($V_{DS}=28\text{V}$, $I_D=2\text{mA}$)	-2.5	-1.6	-0.5	V
V_{GSQ}	Gate Quiescent Voltage ($V_{DS}=28\text{V}$, $I_D=50\text{mA}$)	-2.1	-1.3	-0.3	V
R_{ON}	On Resistance ($V_{DS}=2\text{V}$, $I_D=15\text{mA}$)	-	1.6	-	Ω
$I_{D, MAX}$	Maximum Drain Current ($V_{DS}=7\text{V}$ pulsed, 300 μs pulse width, 0.2% Duty Cycle)	-	1.4	-	A

Thermal Resistance Specification:

Symbol	Parameter	Typ	Units
$R_{\theta JC}$	Thermal Resistance (Junction-to-Case), $T_J = 180^\circ\text{C}$	15	$^\circ\text{C/W}$

Junction Temperature (T_J) measured using IR Microscopy, Case Temperature (T_C) measured using a thermocouple embedded in heatsink.

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
I_G	Gate Current	4	mA
P_T	Total Device Power Dissipation (Derated above 25°C)	11.6	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)	Class 1A	
MSL	Moisture sensitivity level (per IPC/JEDEC J-STD-020)	MSL-3	

Load-Pull Data, Reference Plane at Device Leads

$V_{DS}=28V$, $I_{DQ}=50mA$, $T_C=25^{\circ}C$ unless otherwise noted

Optimum Source and Load Impedances:

(CW Drain Efficiency and Output Power Tradeoff Impedance)

Frequency (MHz)	$Z_S (\Omega)$	$Z_L (\Omega)$	$P_{SAT} (W)$	$G_{SS} (dB)$	Drain Efficiency @ P_{SAT} (%)
900	$6.1 + j15$	$72 + j36$	7.0	23	68
2200	$5.0 - j5.0$	$14 + j17$	6.7	19	66
2700	$5.0 - j10$	$13 - j12$	6.7	17	62
5800	$10 - j60$	$14 - j34$	6.5	11	52

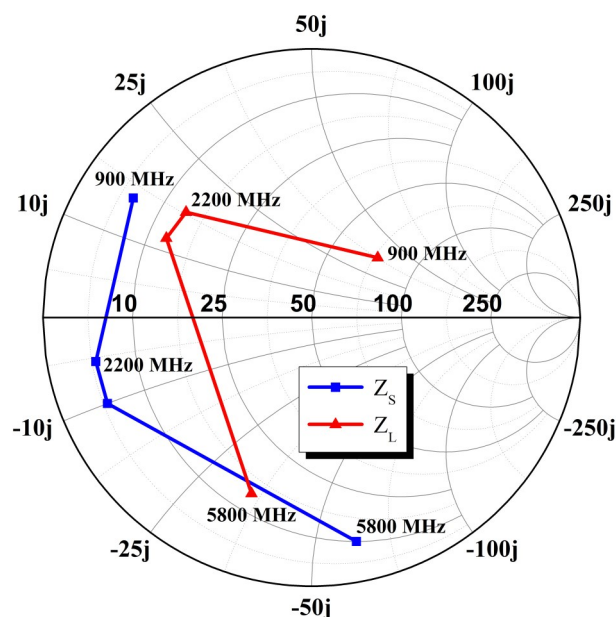
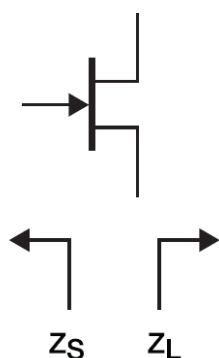


Figure 1: CW Power/Drain Efficiency Tradeoff Impedances, $Z_0=50\Omega$

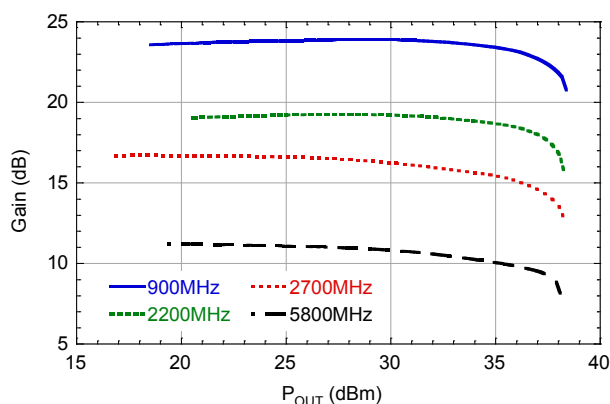


Figure 2: Gain vs. P_{OUT}

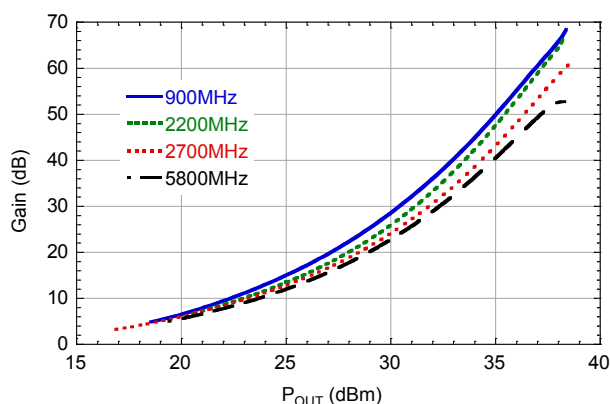


Figure 3: Efficiency vs. P_{OUT}

2.5 GHz Narrowband Circuit

(CW, $V_{DS}=28V$, $I_{DQ}=50mA$, $T_C=25^{\circ}C$, unless otherwise noted)

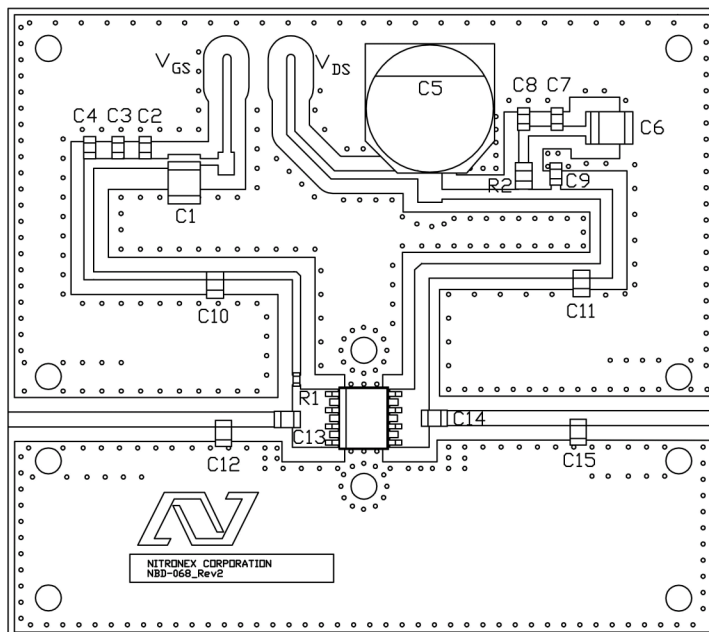


Figure 4: Component Placement of 2.5 GHz Narrowband Circuit for NPTB00004A

Reference	Value	Manufacturer	Part Number
C1, C6	1 μ F	AVX	12101C105KAT2A
C2, C7	0.1 μ F	Murata	GRM188R72A104KA35D
C3, C8	0.01 μ F	AVX	06031C103KAT2A
C4, C9	1000pF	AVX	06031C102KAT2A
C5	100 μ F	Panasonic	ECE-V1JA101P
C10, C11	33pF	ATC	600F330JT
C12	2.4pF	ATC	600F2R4JT
C13	2.7pF	ATC	600F2R7JT
C14	3.3pF	ATC	600F3R3JT
C15	1.5pF	ATC	600F1R5JT
R1	200 Ω	Panasonic	ERJ-2GEJ201X
R2	0.033 Ω	Panasonic	ERJ-6BWJR033W
PCB	RO4350, $\epsilon_R=3.5$, 0.020"	Rogers	Nitronex NBD-068r2

Typical Performance in 2.5 GHz Narrowband Circuit

(CW, $V_{DS}=28V$, $I_{DQ}=50mA$, $f=2.5GHz$, $T_C=25^\circ C$, unless otherwise noted)

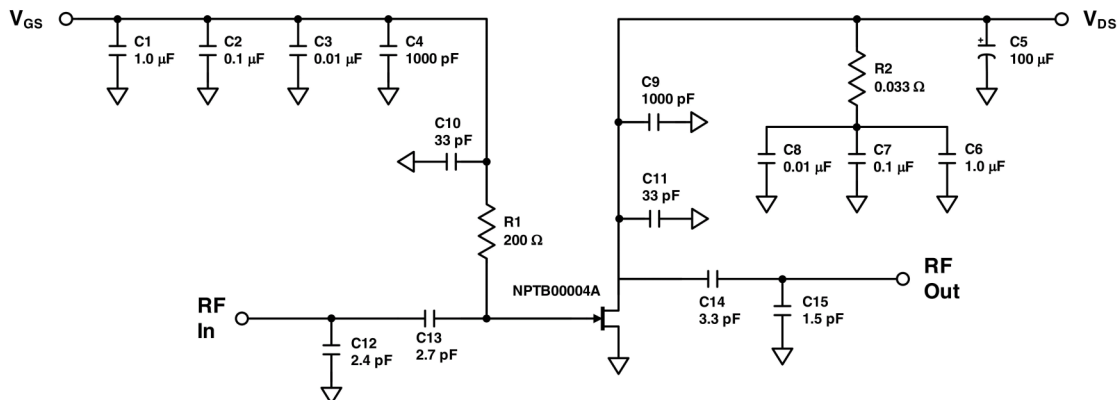


Figure 5. Electrical Schematic of 2.5 GHz Narrowband Circuit for NPTB00004A
(For RF Tuning details see Component Placement Diagram Figure 4)

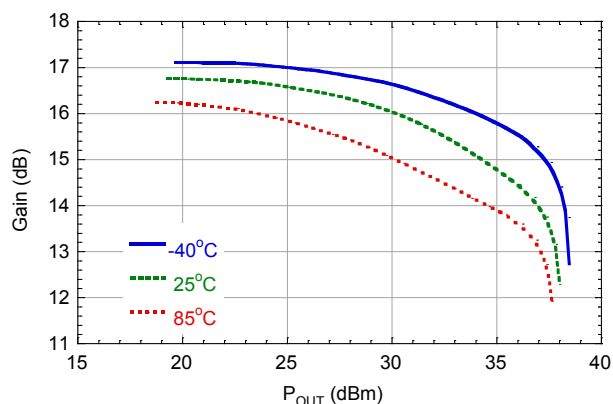


Figure 6: Gain vs. P_{OUT}

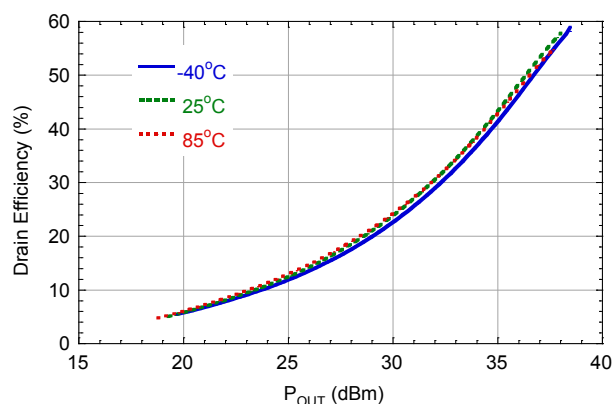


Figure 7: Drain Efficiency vs. P_{OUT}

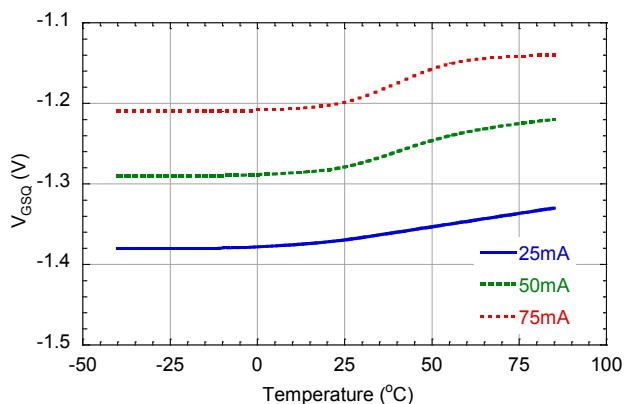


Figure 8: Quiescent V_{GS} vs. Temperature

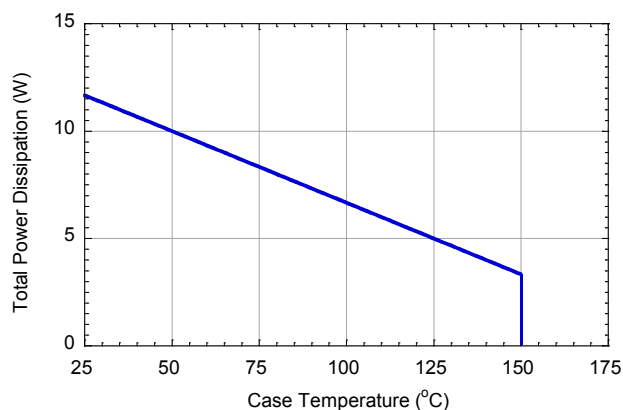


Figure 9: Power De-rating Curve
($T_J = 200^\circ C$, $T_C > 25^\circ C$)

Typical Performance in 2.5 GHz Narrowband Circuit

(CW, $V_{DS}=28V$, $I_{DQ}=50mA$, $f=2.5GHz$, $T_C=25^\circ C$, unless otherwise noted)

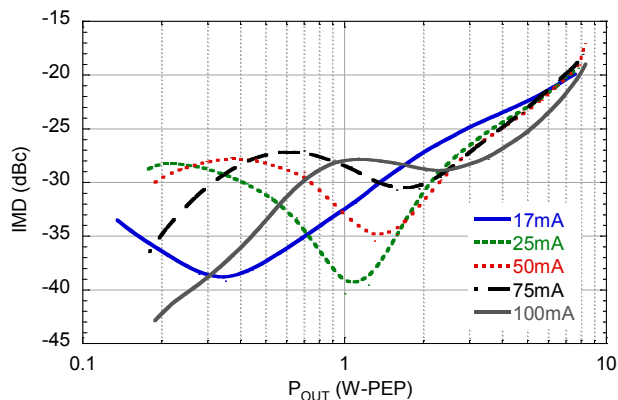


Figure 10: 2-Tone IMD3 vs. P_{OUT} vs. I_{DQ}
(1MHz Tone Spacing)

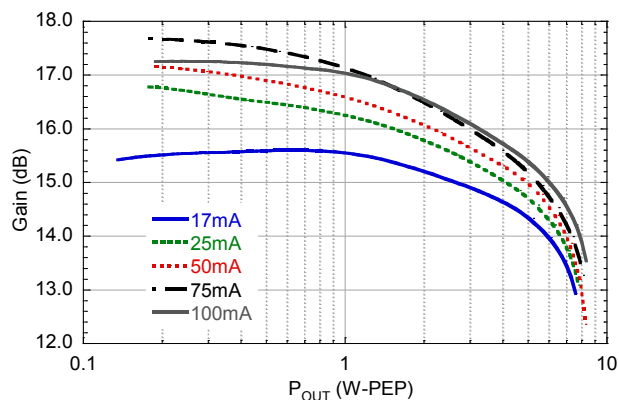


Figure 11: 2-Tone Gain vs. P_{OUT} vs. I_{DQ}
(1MHz Tone Spacing)

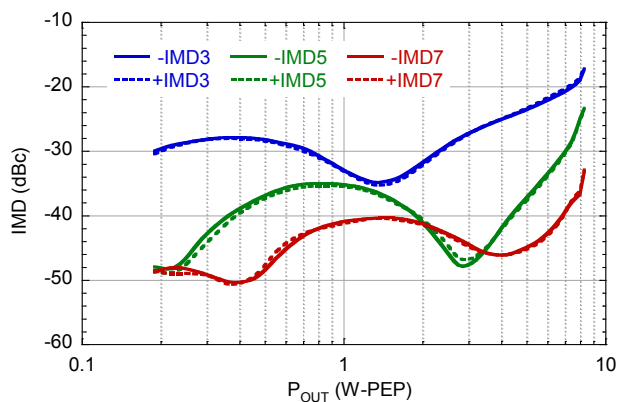


Figure 12: 2-Tone IMD vs. P_{OUT}
(1MHz Tone Spacing)

100-800 MHz Broadband Circuit

(CW, $V_{DS}=28V$, $I_{DQ}=50mA$, $T_C=25^{\circ}C$, unless otherwise noted)

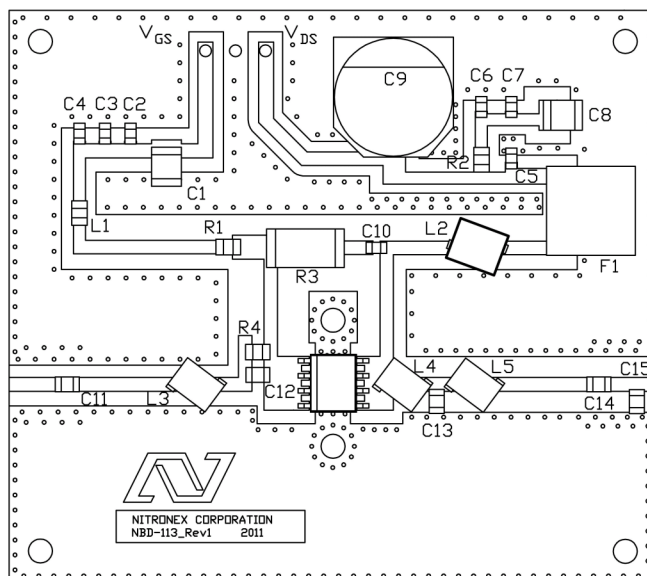


Figure 13: Component Placement of 100-800 MHz Broadband Circuit for NPTB00004A

Reference	Value	Manufacturer	Part Number
C1, C8	1 μ F	AVX	12101C105KAT2A
C2, C7	0.1 μ F	Murata	GRM188R72A104KA35D
C3, C6, C10	0.01 μ F	AVX	06031C103KAT2A
C4, C5,	1000pF	AVX	06031C102KAT2A
C9	100 μ F	Panasonic	ECE-V1JA101P
C11, C14	240pF	ATC	600F241F
C12	10pF	ATC	600F100B
C13, C15	1.5pF	ATC	600F1R5JT
F1	Material 73	Fair-Rite	2673000801
L1	100nH	Coilcraft	0805CS101X
L2	100nH	Coilcraft	1812SMS-R10
L3, L5	5nH	Coilcraft	A02TKLJ
L4	2.5nH	Coilcraft	A01TKLJ
R1	300 Ω	Panasonic	ERJ-14YJ301U
R2	0.33 Ω	Susumu	RL1220S-R33-F
R3	470 Ω	Stackpole	RHC2512FT470R
R4	10 Ω	Panasonic	ERJ-14YJ100U
PCB	RO4350, $\epsilon_R=3.5$, 0.020"	Rogers	Nitronex NBD-113r1

Typical Performance in 100-800 MHz Broadband Circuit

(CW, $V_{DS}=28V$, $I_{DQ}=50mA$, $T_C=25^\circ C$, unless otherwise noted)

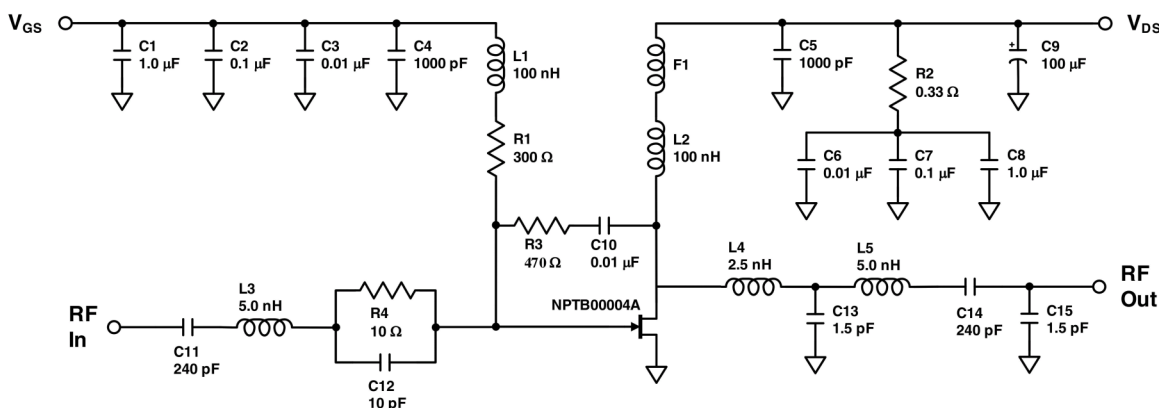


Figure 14. Electrical Schematic of 100-800 MHz Broadband Circuit for NPTB00004A
(For RF Tuning details see Component Placement Diagram Figure 13)

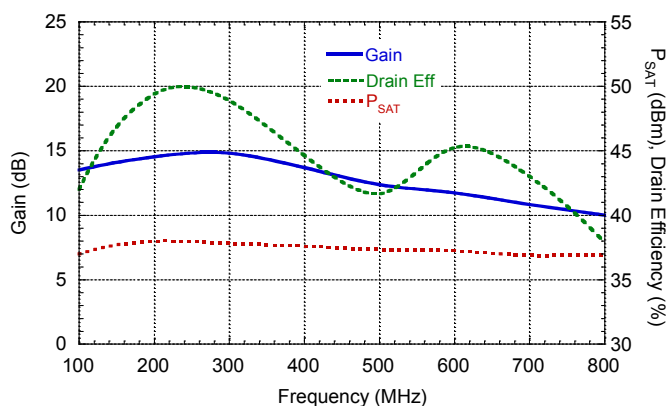


Figure 15: Performance vs. Frequency
($P_{OUT} = P_{SAT}$)

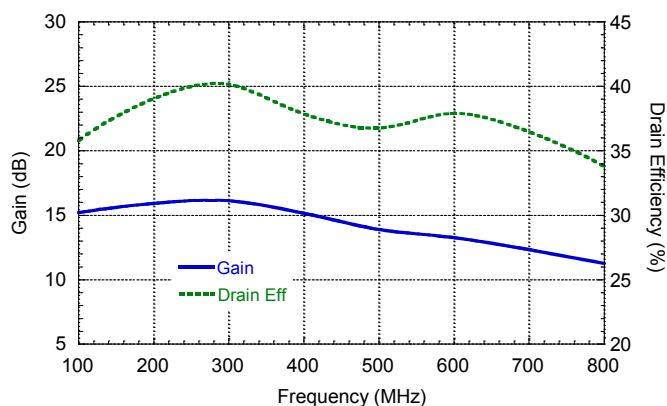


Figure 16: Performance vs. Frequency
($P_{OUT} = 36dBm$)

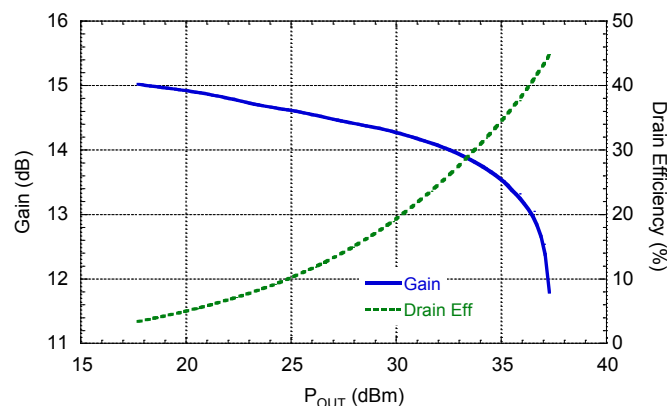


Figure 17: Performance vs. P_{OUT}
($f = 600MHz$)

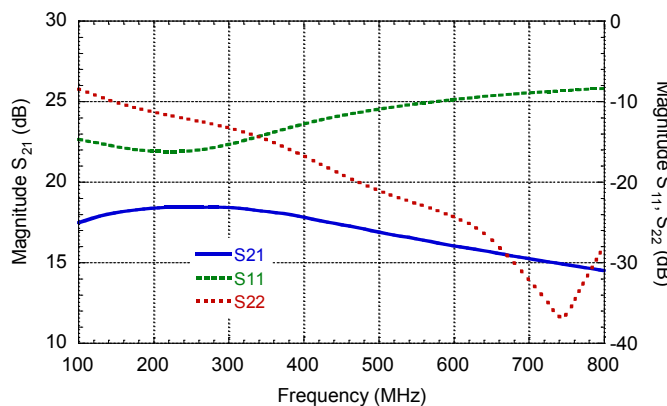


Figure 18: Small Signal s-parameters vs. Frequency

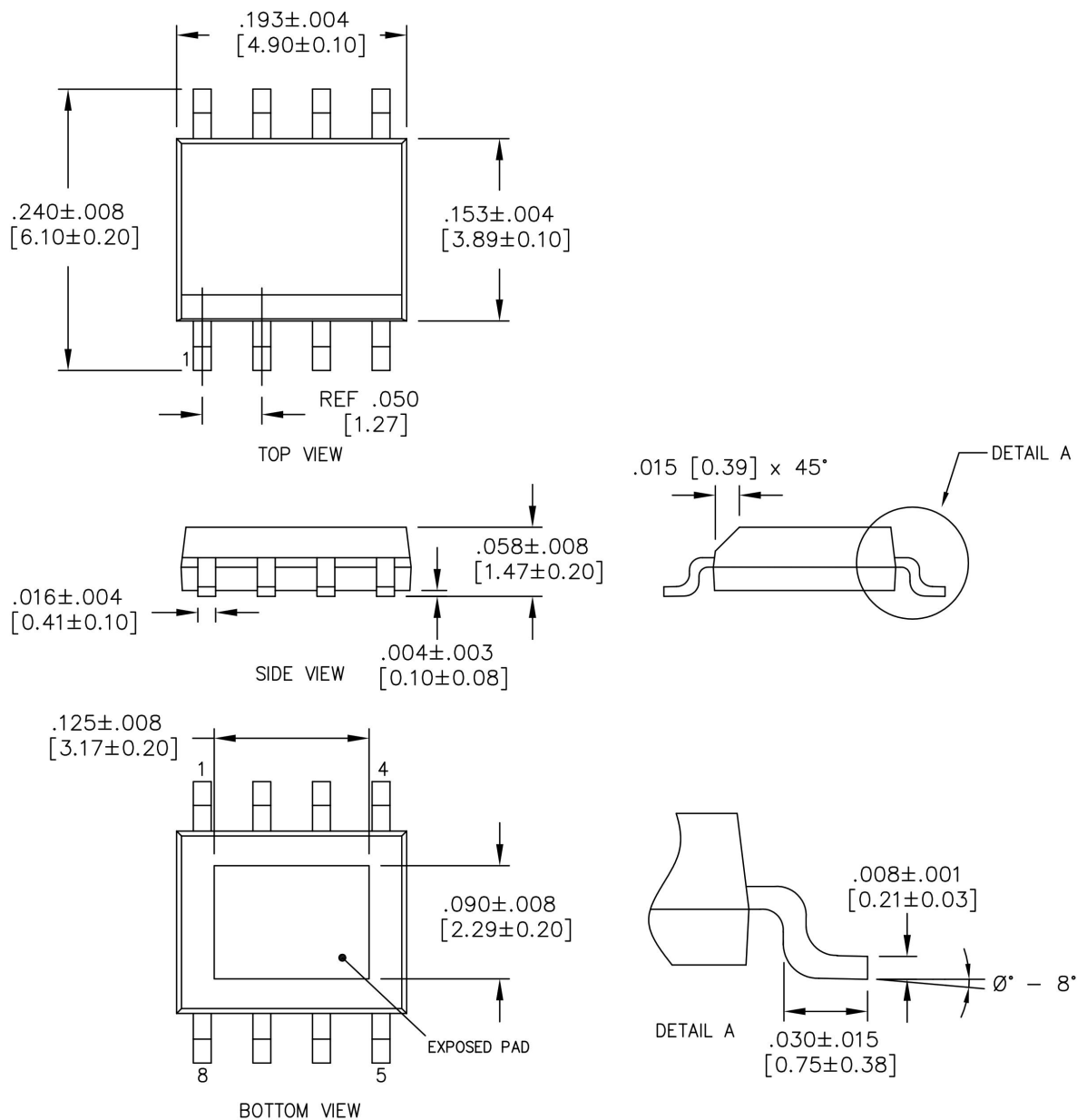


Figure 19 - SOIC-8NE Plastic Package Dimensions (all dimensions in inches [millimeters])

Pin	Function
2, 3	Gate — RF Input
6, 7	Drain — RF Output
Exposed Pad	Source — Ground
1, 4, 5, 8	No Connect*

* All No Connect pins may be left floating or grounded

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 2013 All rights reserved.