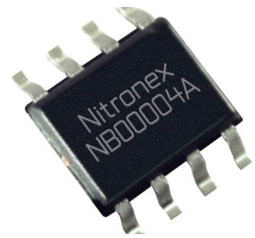
NPTB00004A

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

RoHS

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°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			

DC Specifications: T_C = 25°C

Symbol	Parameter	Min	Typ	Max	Units
Off Characteristics					
I_{DLK}	Drain-Source Leakage Current (V_{GS}=-8V, V_{DS}=100V)	-	-	2	mA
I_{GLK}	Gate-Source Leakage Current (V_{GS}=-8V, V_{DS}=0V)	-	-	1	mA
On Characteristics					
V_T	Gate Threshold Voltage (V_{DS}=28V, I_D=2mA)	-2.5	-1.6	-0.5	V
V_{GSQ}	Gate Quiescent Voltage (V_{DS}=28V, I_D=50mA)	-2.1	-1.3	-0.3	V
R_{ON}	On Resistance (V_{DS}=2V, I_D=15mA)	-	1.6	-	Ω
$I_{D, MAX}$	Maximum Drain Current (V_{DS}=7V pulsed, 300μS 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 °C	15	°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°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	°C
T_J	Operating Junction Temperature	200	°C
HBM	Human Body Model ESD Rating (per JESD22-A114)	Class 1A	
MSL	Moisture sensitivity level (per IPC/JEDEC J-STD-020)	MSL-3	

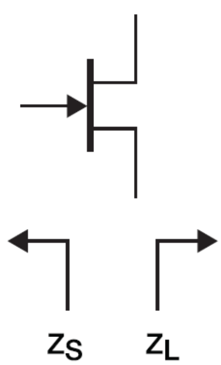
Load-Pull Data, Reference Plane at Device Leads

V_{DS}=28V, I_{DQ}=50mA, T_C=25°C unless otherwise noted

Optimum Source and Load Impedances:

(CW Drain Efficiency and Output Power Tradeoff Impedance)

Frequency (MHz)	Z_S (Ω)	Z_L (Ω)	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



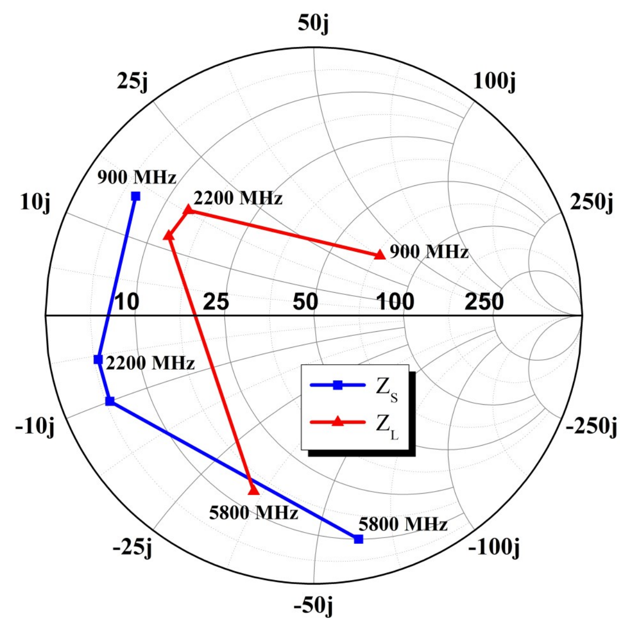


Figure 1: CW Power/Drain Efficiency Tradeoff Impedances, Z_O=50Ω

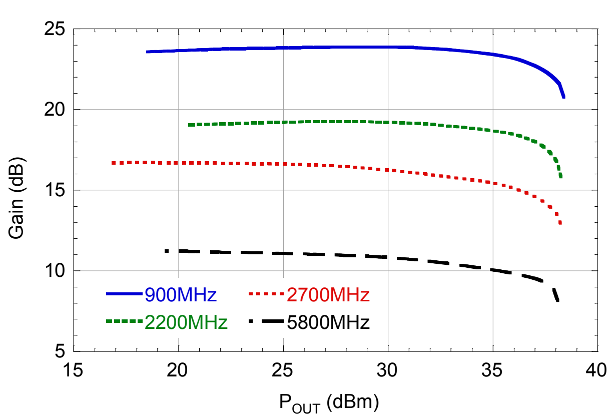


Figure 2: Gain vs. P_{OUT}

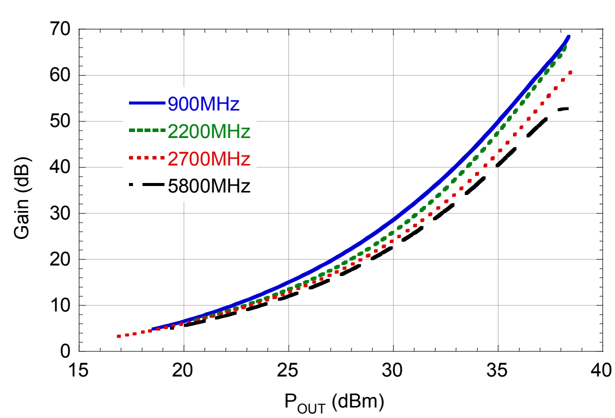


Figure 3: Efficiency vs. P_{OUT}

2.5 GHz Narrowband Circuit

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

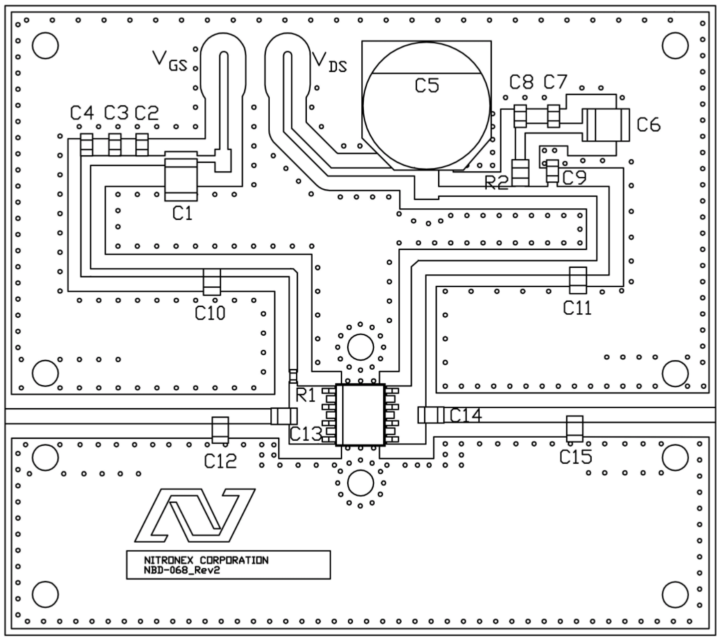


Figure 4: Component Placement of 2.5 GHz Narrowband Circuit for NPTB00004A

Reference	Value	Manufacturer	Part Number
C1, C6	1µF	AVX	12101C105KAT2A
C2, C7	0.1µF	Murata	GRM188R72A104KA35D
C3, C8	0.01µF	AVX	06031C103KAT2A
C4, C9	1000pF	AVX	06031C102KAT2A
C5	100µF	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	200Ω	Panasonic	ERJ-2GEJ201X
R2	0.033Ω	Panasonic	ERJ-6BWJR033W
PCB	RO4350, ε_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°C, unless otherwise noted)

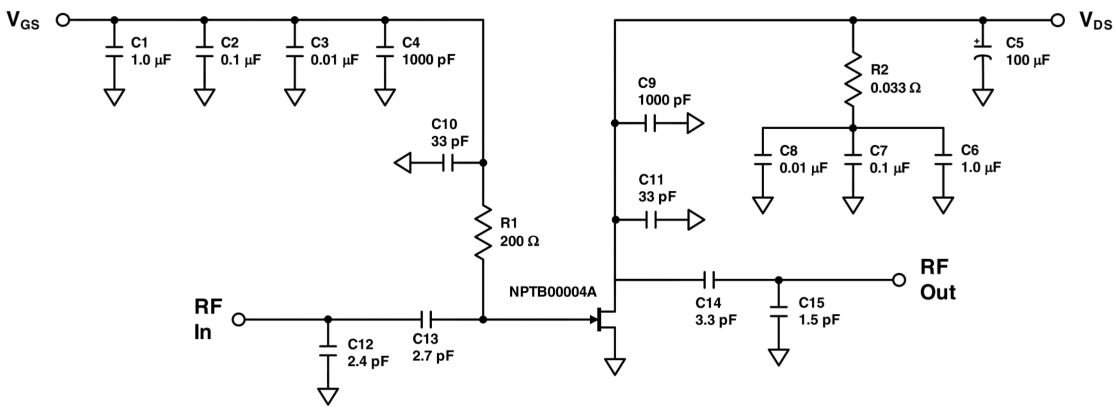


Figure 5. Electrical Schematic of 2.5 GHz Narrowband Circuit for NPTB00004A
(For RF Tuning details see Component Placement Diagram Figure 4)

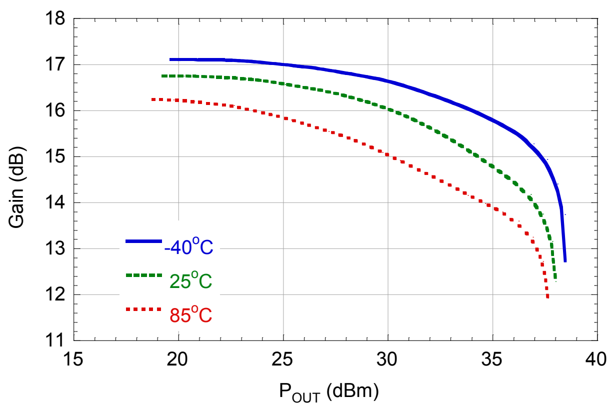


Figure 6: Gain vs. P_{OUT}

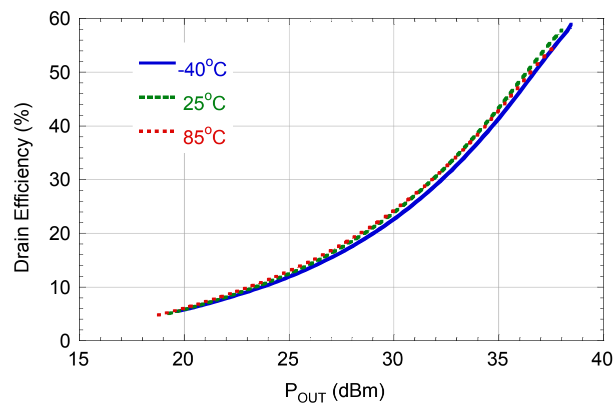


Figure 7: Drain Efficiency vs. P_{OUT}

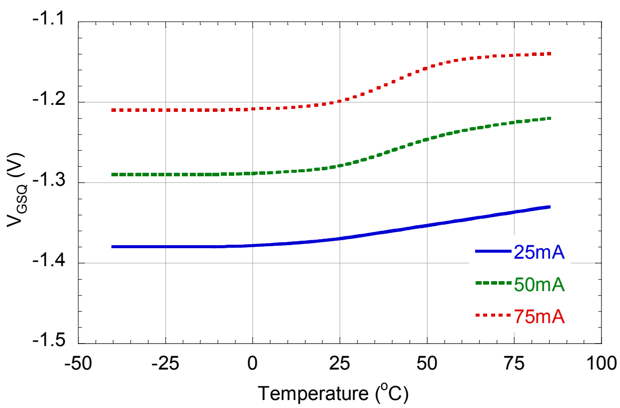


Figure 8: Quiescent V_{GS} vs. Temperature

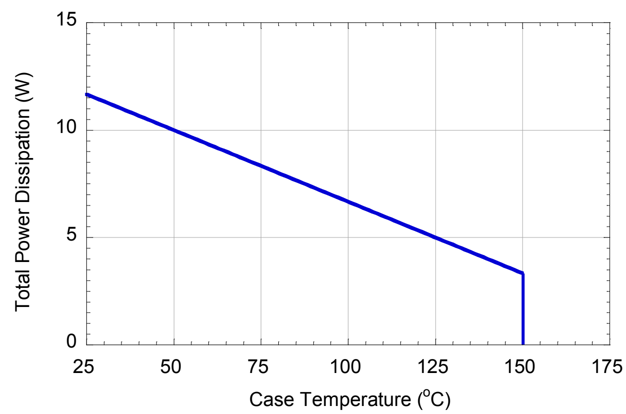


Figure 9: Power De-rating Curve
(T_J = 200°C, T_C > 25°C)

Typical Performance in 2.5 GHz Narrowband Circuit

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

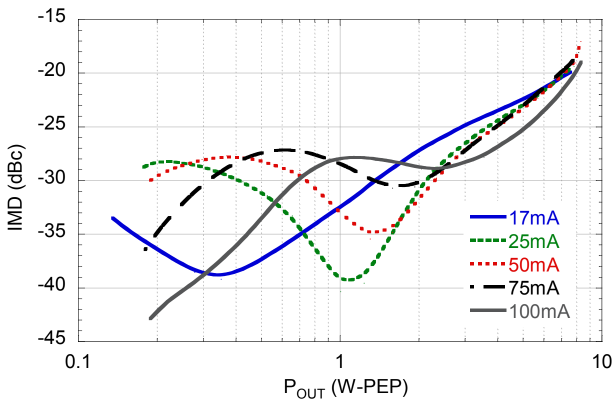


Figure 10: 2-Tone IMD3 vs. P_{OUT} vs. I_{DQ} (1MHz Tone Spacing)

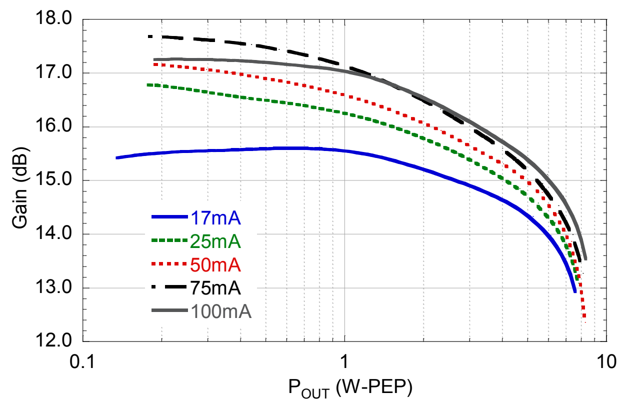


Figure 11: 2-Tone Gain vs. P_{OUT} vs. I_{DQ} (1MHz Tone Spacing)

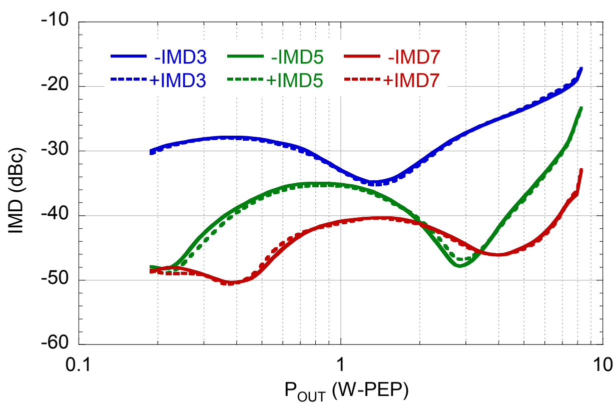


Figure 12: 2-Tone IMD vs. P_{OUT} (1MHz Tone Spacing)

100-800 MHz Broadband Circuit

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

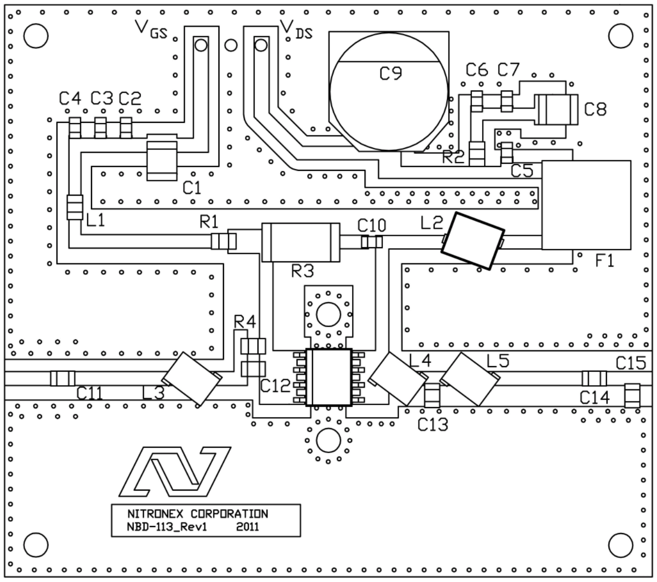


Figure 13: Component Placement of 100-800 MHz Broadband Circuit for NPTB00004A

Reference	Value	Manufacturer	Part Number
C1, C8	1μF	AVX	12101C105KAT2A
C2, C7	0.1μF	Murata	GRM188R72A104KA35D
C3, C6, C10	0.01μF	AVX	06031C103KAT2A
C4, C5,	1000pF	AVX	06031C102KAT2A
C9	100μF	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	300Ω	Panasonic	ERJ-14YJ301U
R2	0.33Ω	Susumu	RL1220S-R33-F
R3	470Ω	Stackpole	RHC2512FT470R
R4	10Ω	Panasonic	ERJ-14YJ100U
PCB	RO4350, ε_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°C, unless otherwise noted)

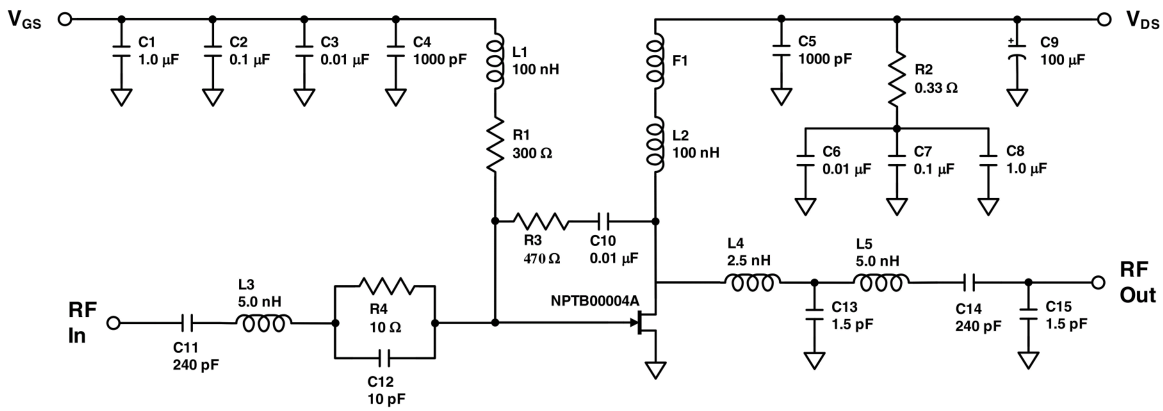


Figure 14. Electrical Schematic of 100-800 MHz Broadband Circuit for NPTB0004A (For RF Tuning details see Component Placement Diagram Figure 13)

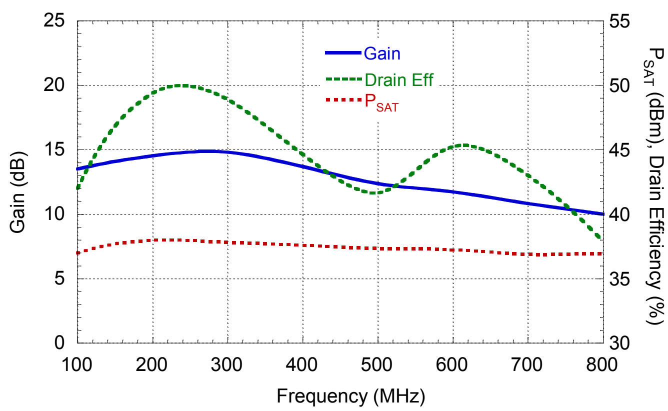


Figure 15: Performance vs. Frequency (P_{OUT} = P_{SAT})

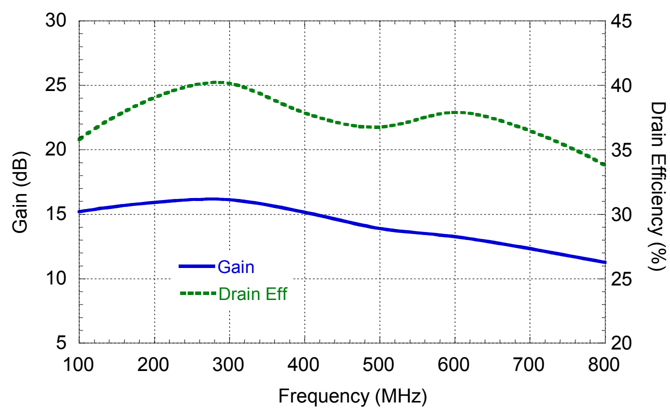


Figure 16: Performance vs. Frequency (P_{OUT} = 36dBm)

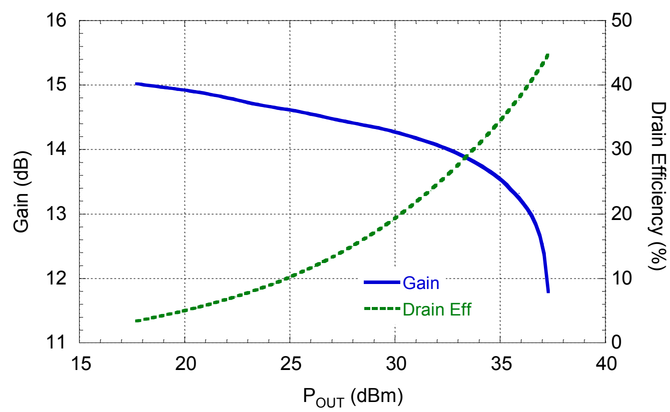


Figure 17: Performance vs. P_{OUT} (f = 600MHz)

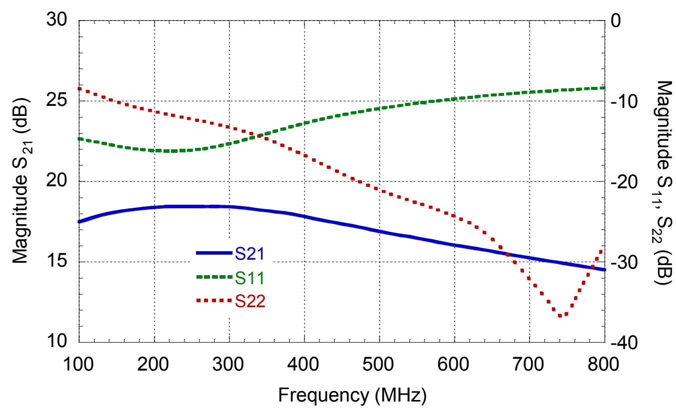


Figure 18: Small Signal s-parameters vs. Frequency

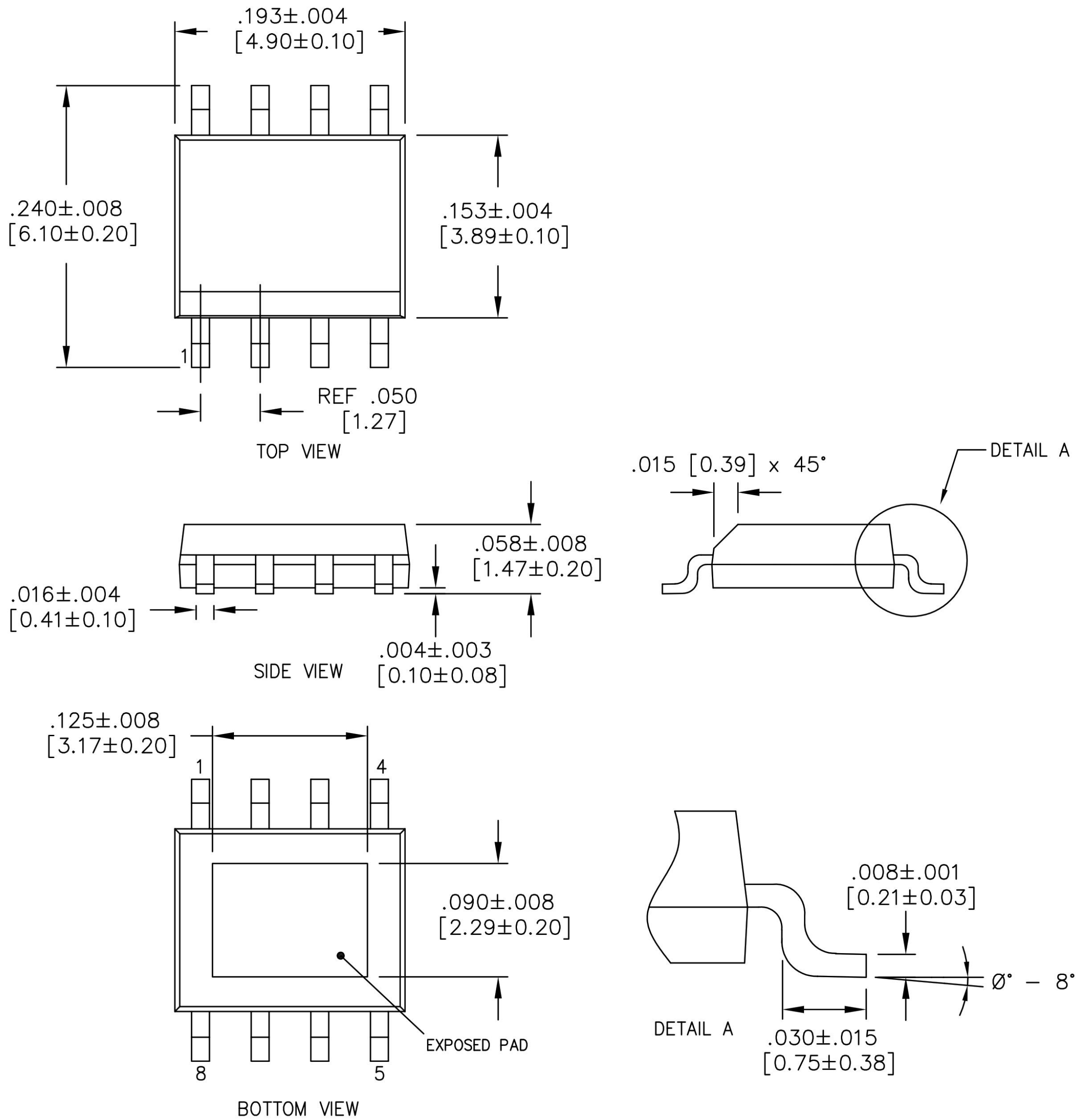


Figure 19 - SOIC-8NE Plastic Package Dimensions (all dimensions in inches [millimeters])

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

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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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