NPA1003

Gallium Nitride 28V, 5W, 20-1500 MHz MMIC Amplifier

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

Features

- Broadband operation from 20-1500 MHz
- 28V Operation
- Input and output matched to 50 ohms
- Industry Standard QFN Plastic Package
- High Drain Efficiency (>50%)

Applications

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

20-1500 MHz
5W
GaN MMIC PA

RoHS

Product Description

The NPA1003 is a wideband, internally-matched, GaN MMIC power amplifier optimized for 20-1500 MHz operation. This device has been designed for CW, pulsed, and linear operation with output power levels exceeding 5W (37 dBm) in an industry standard, surface mount, QFN4X4-16 plastic package.

RF Specifications (CW, 1000 MHz): V_{DS} = 28V, I_{DQ} = 100mA, T_C= 25°C

Symbol	Parameter	Min	Typ	Max	Units
G_{SS}	Small-signal Gain	-	18	-	dB
P_{SAT}	Saturated Output Power	-	38.5	-	dBm
η_{SAT}	Efficiency at Saturated Output Power	-	50	-	%
NF	Noise Figure	-	2.0	-	dB
G_P	Gain at P_{OUT} = 5W	14	16	-	dB
PAE	Power Added Efficiency at P_{OUT} = 5W	38	42	-	%
V_{DS}	Drain Voltage	-	28	-	V
Ψ	Ruggedness: Output Mismatch, all phase angles	VSWR = 10:1, 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=100mA)	-2.1	-1.2	-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)	-	1.5	-	A

Thermal Resistance Specification:

Symbol	Parameter	Typ	Units
$R_{\theta JC}$	Thermal Resistance (Junction-to-Case), T_J = 180 °C	12	°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)	14.5	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-1	

20 - 1500 MHz Broadband Circuit

(CW, V_{DS}=28V, I_{DQ}=100mA, T_C=25°C, unless otherwise noted)

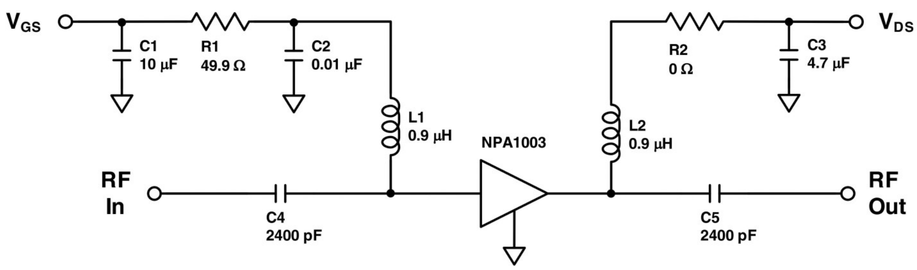

Figure 1. Electrical Schematic of 20 - 1500MHz Broadband Circuit for NPA1003
(For RF Tuning details see Component Placement Diagram Figure 2)

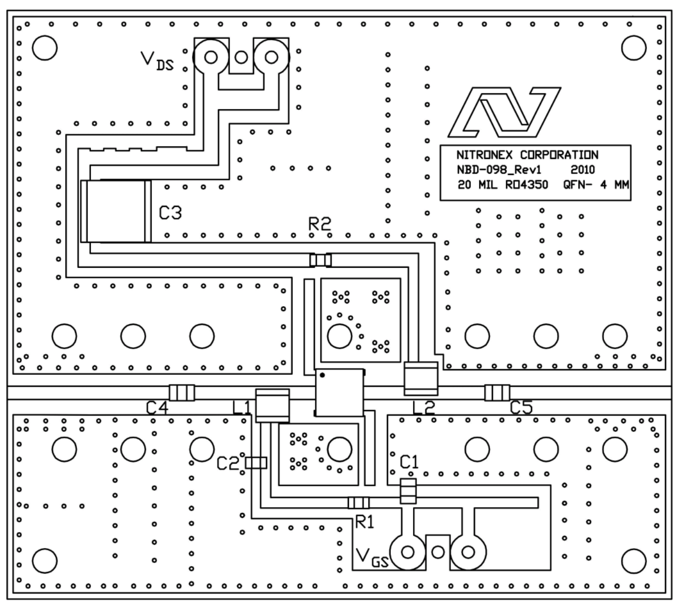

Figure 2: Component Placement of 20 - 1500MHz Broadband Circuit for NPA1003

Reference	Value	Manufacturer	Part Number
C1	10µF	TDK	C2012X5R1C106M085AC
C2	0.01µF	AVX	06031C103JAT2A
C3	4.7µF	TDK	C5750X7R2A475K230KA
C4, C5	2400pF	Dielectric Labs, Inc.	C08BL242X-5UN-X0
R1	49.9Ω	Panasonic	ERJ-6ENF49R9V
R2	0Ω	Panasonic	ERJ-3GEY0R00V
L1, L2	0.9µH	Coilcraft	1008AF-901XJLC
PCB	RO4350, ε_r=3.5, 0.020”	Rogers	Nitronex NBD-098r1

Typical Performance in 20 - 1500 MHz Broadband Circuit

(CW, V_{DS}=28V, I_{DQ}=100mA, T_C=25°C, unless otherwise noted)

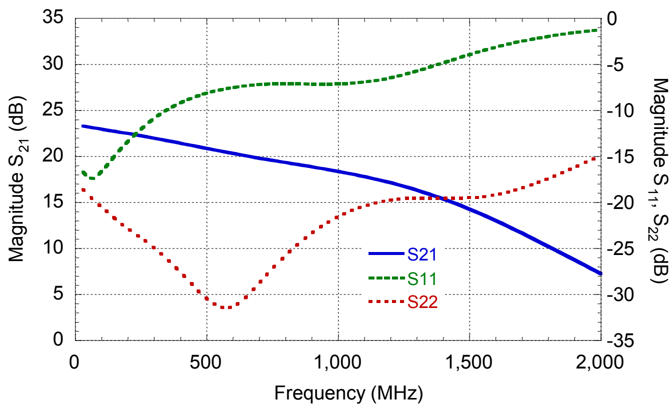

Figure 3: Device Small Signal s-parameters
(s-parameters available at nitronex.com)

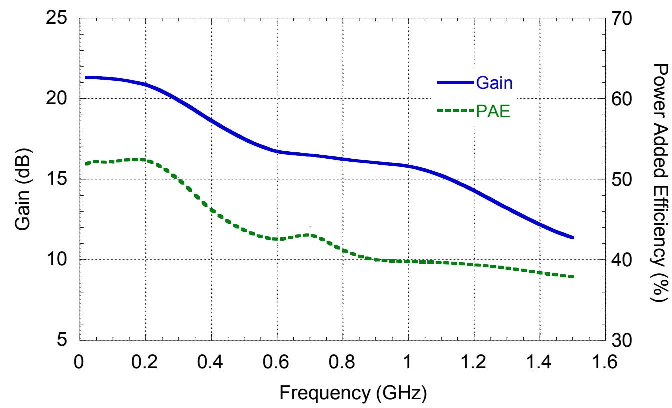

Figure 4: Performance vs. Frequency
(P_{OUT} = 37dBm)

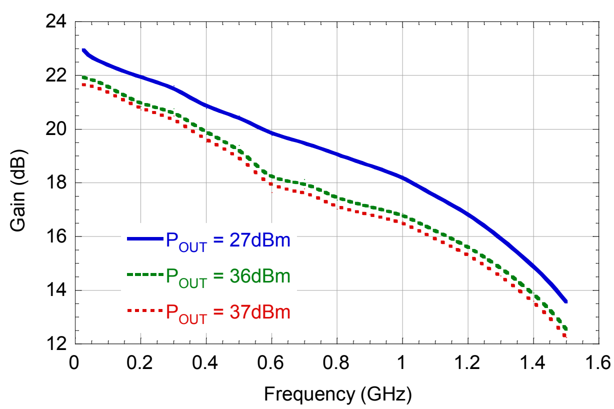

Figure 5: Gain vs. Frequency

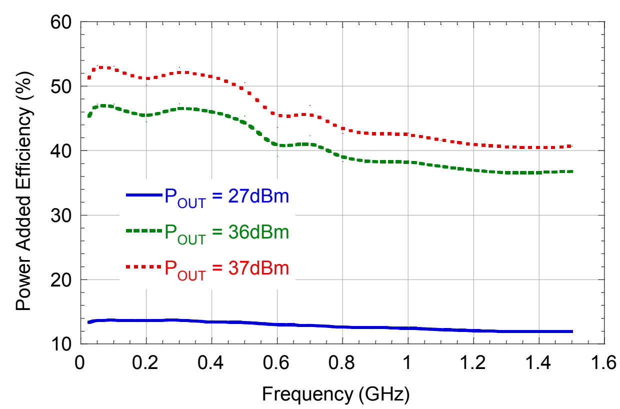

Figure 6: Power Added Efficiency vs. Frequency

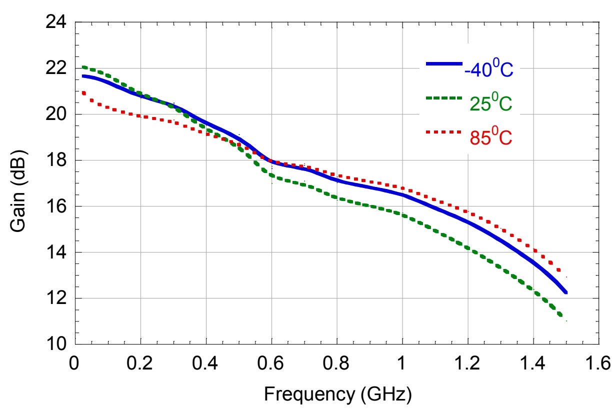

Figure 7: Gain vs. Frequency
(P_{OUT} = 37dBm)

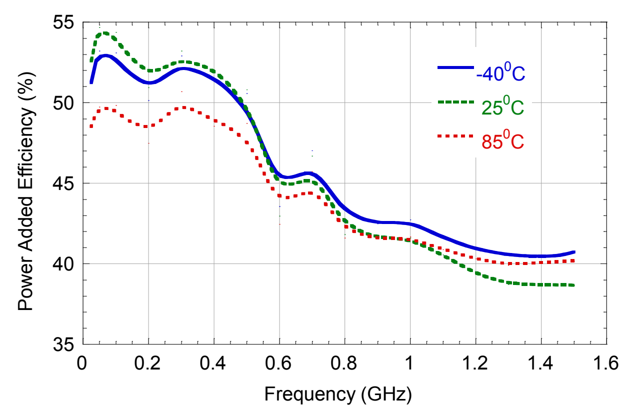

Figure 8: Power Added Efficiency vs. Frequency
(P_{OUT} = 37dBm)

Typical Performance in 20 - 1500 MHz Broadband Circuit

(CW, V_{DS}=28V, I_{DQ}=100mA, T_C=25°C, unless otherwise noted)

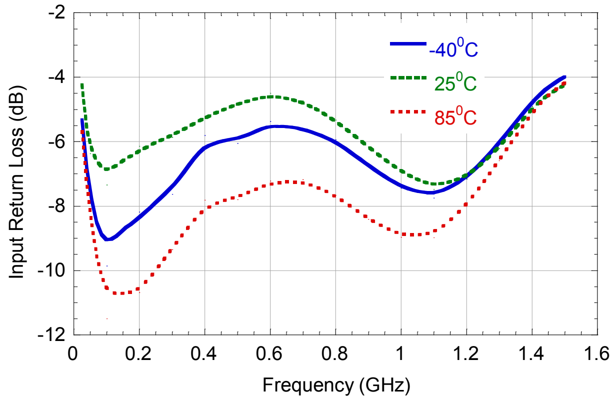

Figure 9: Input Return Loss vs. Frequency (P_{OUT} = 37dBm)

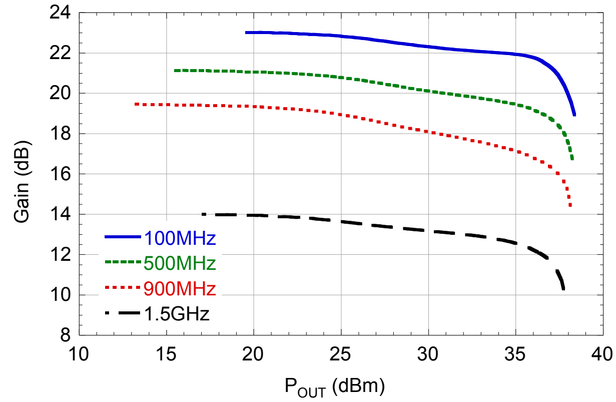

Figure 10: Gain vs. P_{OUT}

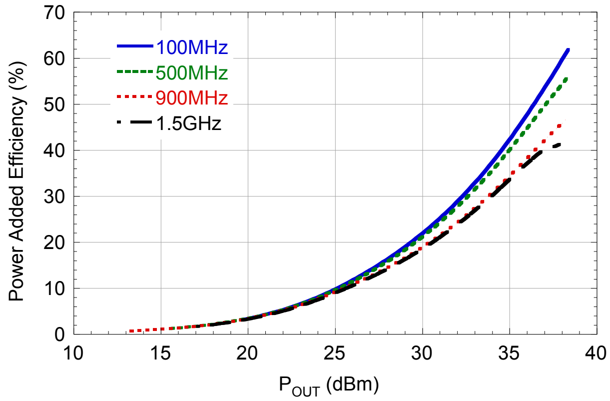

Figure 11: Power Added Efficiency vs. P_{OUT}

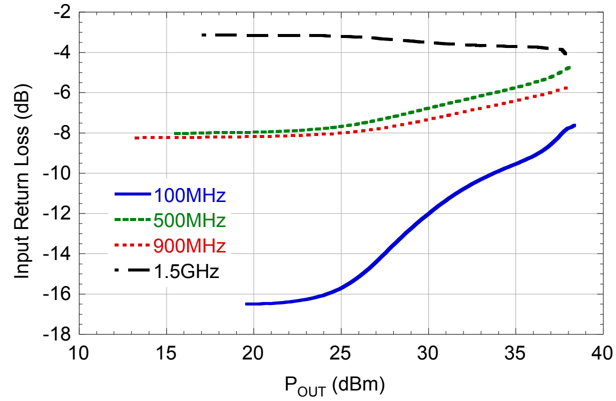

Figure 12: Input Return Loss vs. P_{OUT}

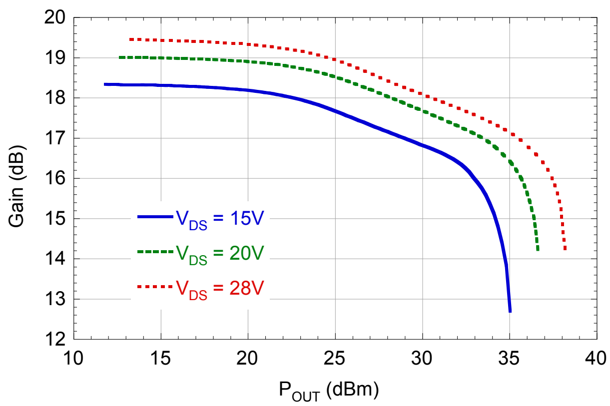

Figure 13: Gain vs. P_{OUT} (f = 900MHz)

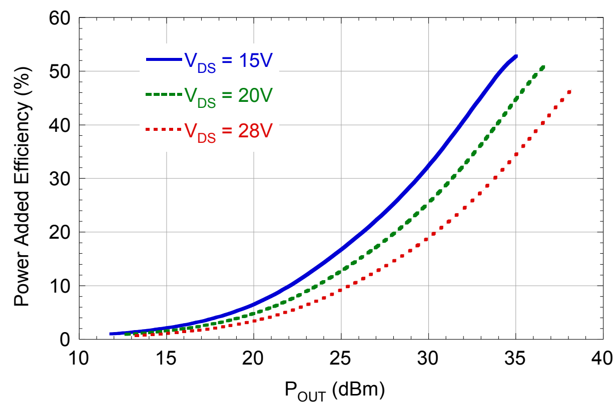

Figure 14: Power Added Efficiency vs. P_{OUT} (f = 900MHz)

Typical Performance in 20 - 1500 MHz Broadband Circuit

(CW, V_{DS}=28V, I_{DQ}=100mA, f=1GHz, T_C=25°C, unless otherwise noted)

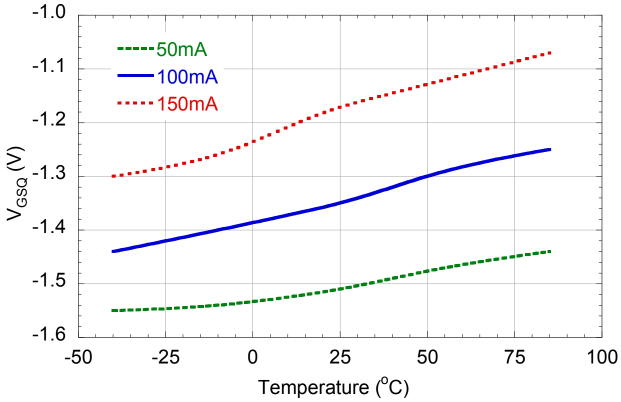

Figure 15: Quiescent V_{GS} vs. Temperature

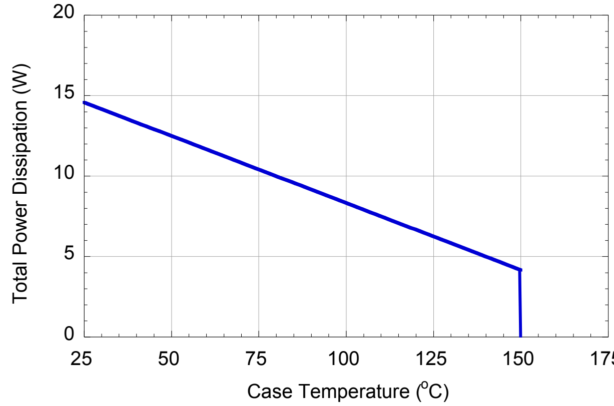

Figure 16: Power De-rating Curve
(T_J = 200°C, T_C > 25°C)

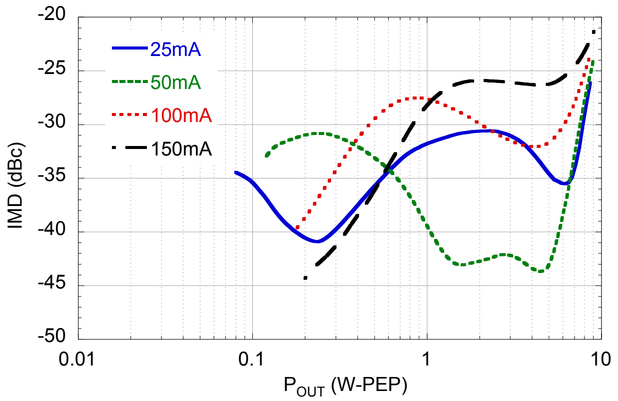

Figure 17: 2-Tone IMD3 vs. P_{OUT} vs. I_{DQ}
(1MHz Tone Spacing, f = 500MHz)

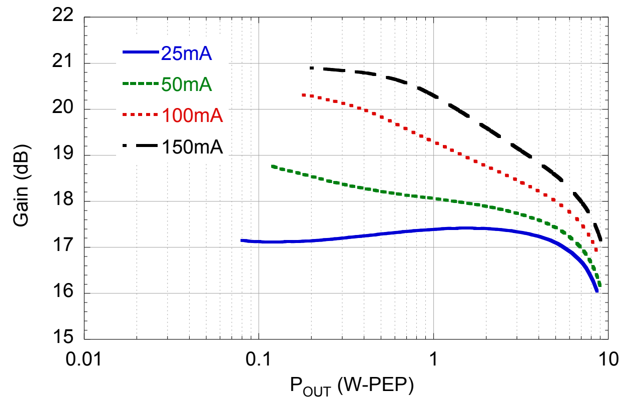

Figure 18: 2-Tone Gain vs. P_{OUT} vs. I_{DQ}
(1MHz Tone Spacing, f = 500MHz)

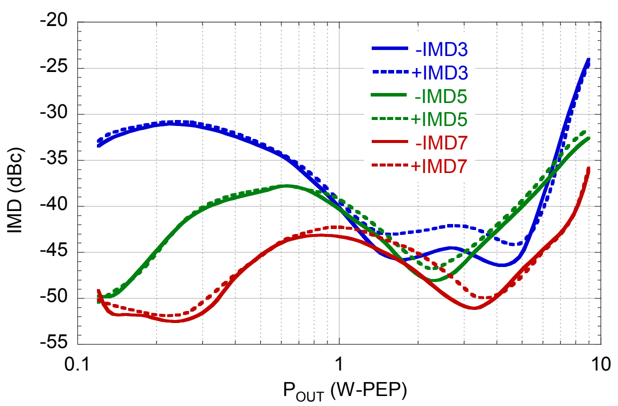

Figure 19: 2-Tone IMD vs. P_{OUT}
(1MHz Tone Spacing, I_{DQ} = 50mA, f = 500MHz)

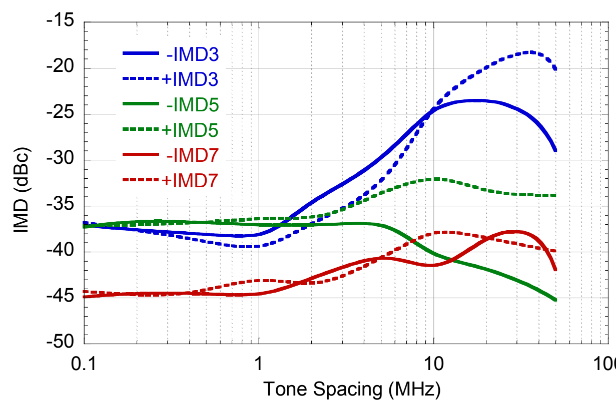

Figure 20: 2-Tone IMD vs. Tone Spacing
(P_{OUT} = 6W-PEP, I_{DQ} = 50mA, f = 500MHz)

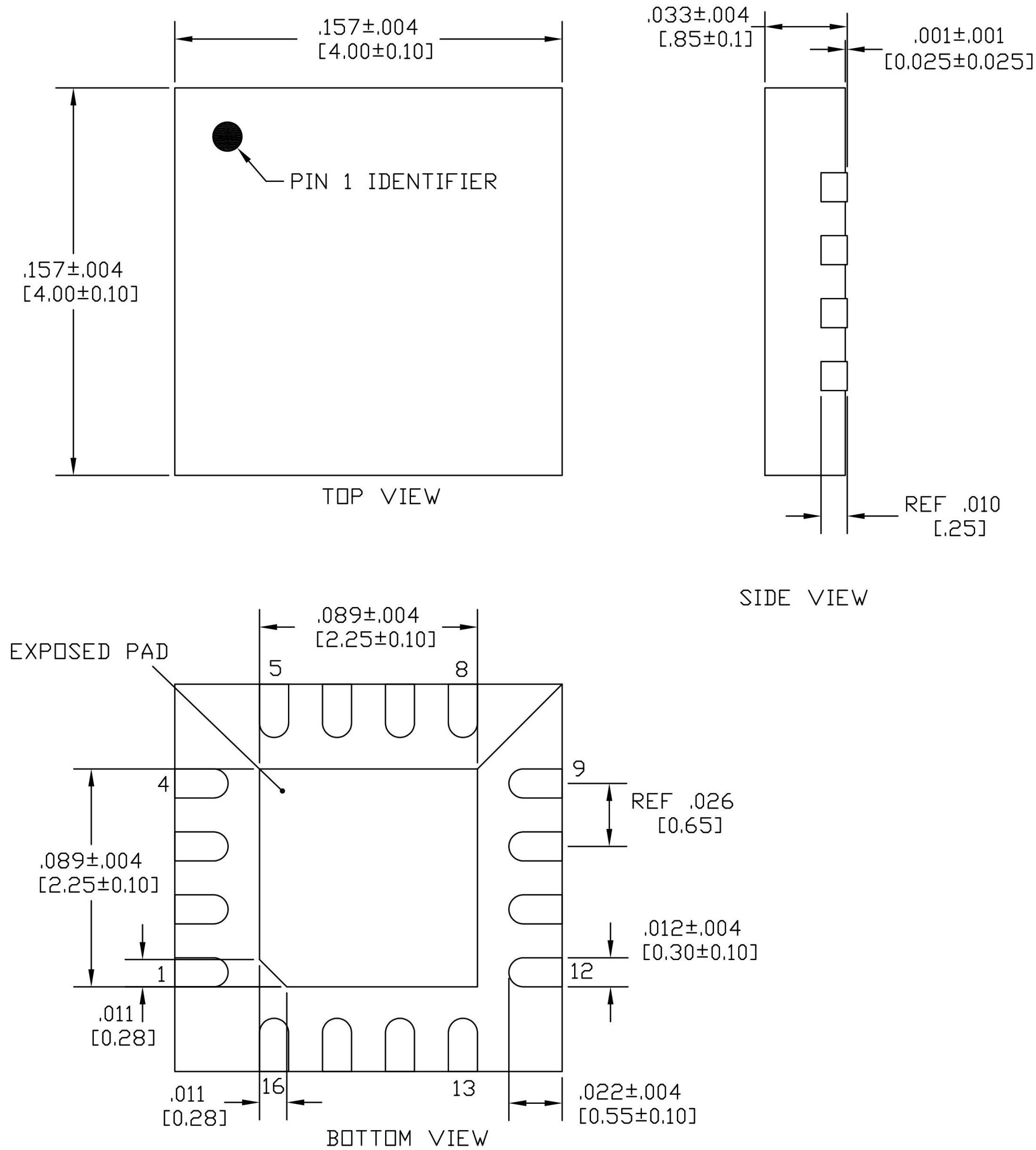

Figure 21 - QFN4X4-16 Plastic Package Dimensions (all dimensions in inches [millimeters])

Pin	Function
2, 3	Gate — RF Input
10, 11	Drain — RF Output
Exposed Pad	Source — Ground
1, 4-9, 12-16	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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