

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



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): $V_{DS} = 28V$, $I_{DQ} = 100mA$, $T_C = 25^\circ C$

Symbol	Parameter	Min	Typ	Max	Units
G_{SS}	Small-signal Gain	-	17	-	dB
P_{SAT}	Saturated Output Power	-	38.5	-	dBm
η_{SAT}	Efficiency at Saturated Output Power	-	50	-	%
G_P	Gain at $P_{OUT} = 5W$	-	15	-	dB
η	Drain Efficiency at $P_{OUT} = 5W$	-	40	-	%
PAE	Power Added Efficiency at $P_{OUT} = 5W$	-	39	-	%
V_{DS}	Drain Voltage	-	28	-	V
Ψ	Ruggedness: Output Mismatch, all phase angles	VSWR = 10:1, No Device Damage			

NPA1003



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	-1.5	-0.5	V
V_{GSQ}	Gate Quiescent Voltage ($V_{DS}=28\text{V}$, $I_D=100\text{mA}$)	-2.1	-1.2	-0.3	V
R_{ON}	On Resistance ($V_{DS}=2\text{V}$, $I_D=15\text{mA}$)	-	2.0	-	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), $T_J = 180^\circ\text{C}$	12	$^\circ\text{C/W}$

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)	14.5	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-1	

20 - 1500 MHz Broadband Circuit

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

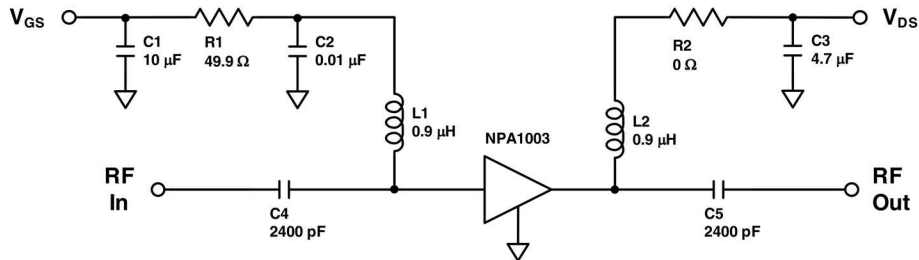


Figure 1. Electrical Schematic of 20 - 1500MHz Broadband Circuit for NPA1003
(For RF Tuning details see Component Placement Diagram Figure 2)

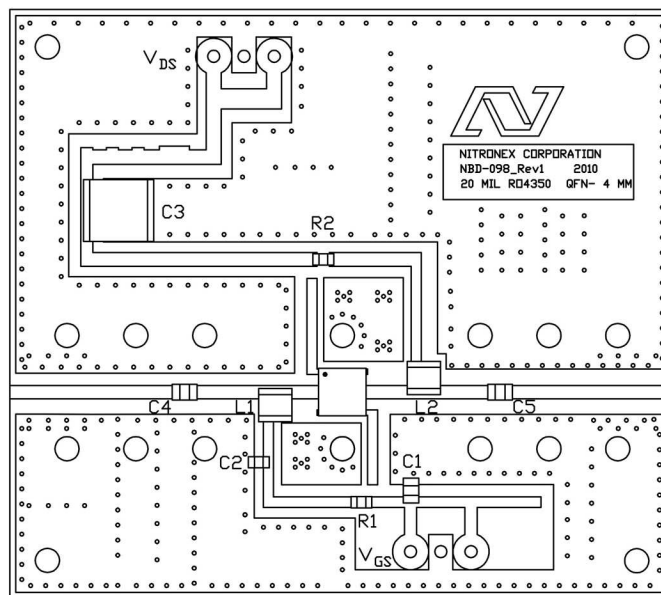


Figure 2: Component Placement of 20 - 1500MHz Broadband Circuit for NPA1003

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, $\epsilon_r=3.5$, 0.020"	Rogers	Nitronex NBD-098r1

Typical Performance in 20 - 1500 MHz Broadband Circuit

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

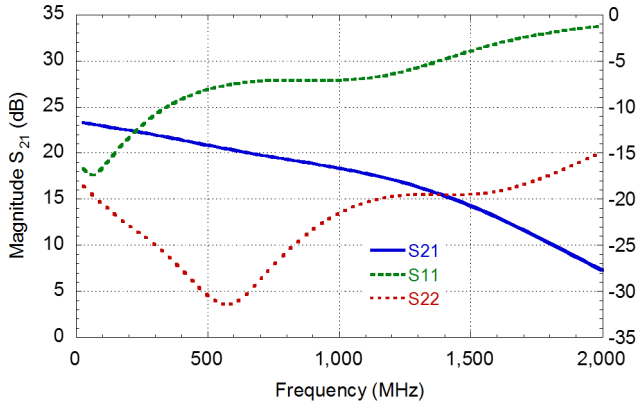


Figure 3: Device Small Signal s-parameters
(s-parameters available at nitronex.com)

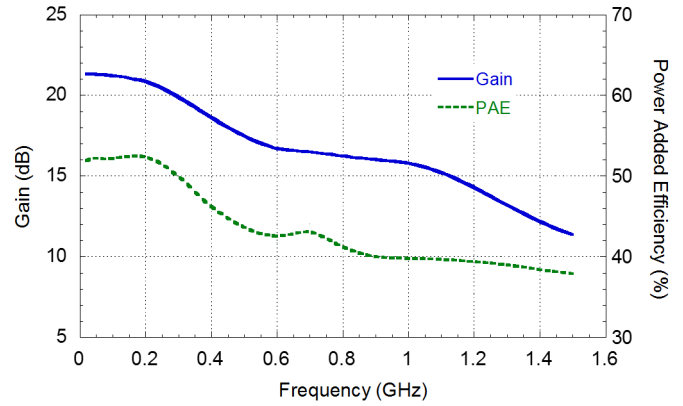


Figure 4: Performance vs. Frequency
($P_{OUT} = 37dBm$)

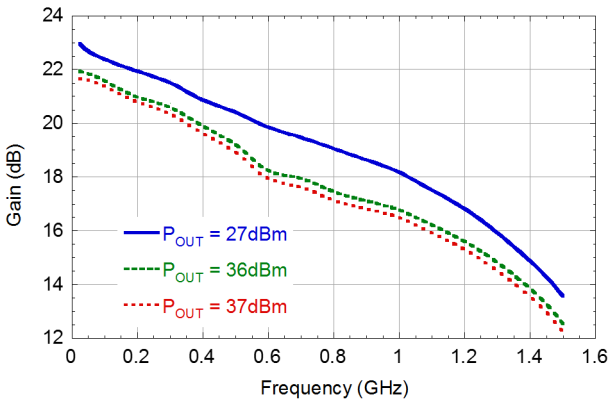


Figure 5: Gain vs. Frequency

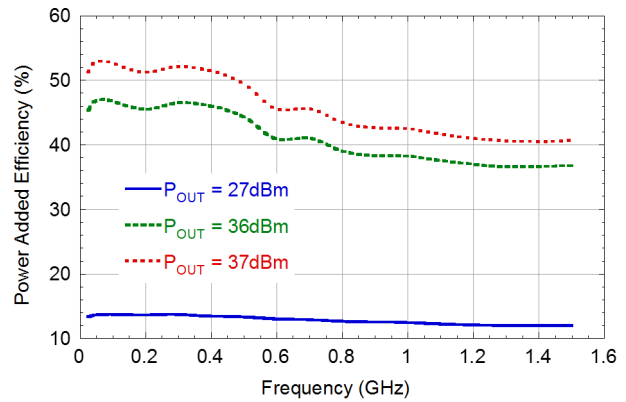


Figure 6: Power Added Efficiency vs. Frequency

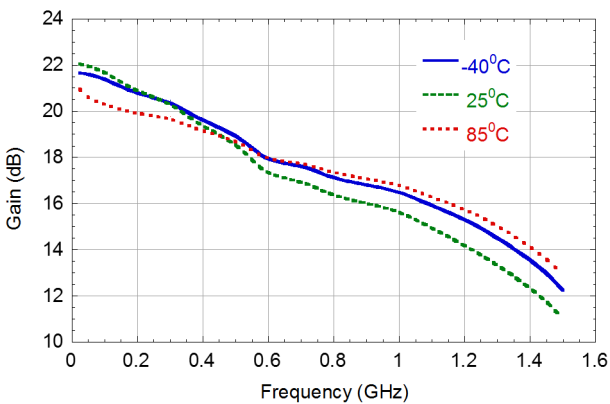


Figure 7: Gain vs. Frequency
($P_{OUT} = 37dBm$)

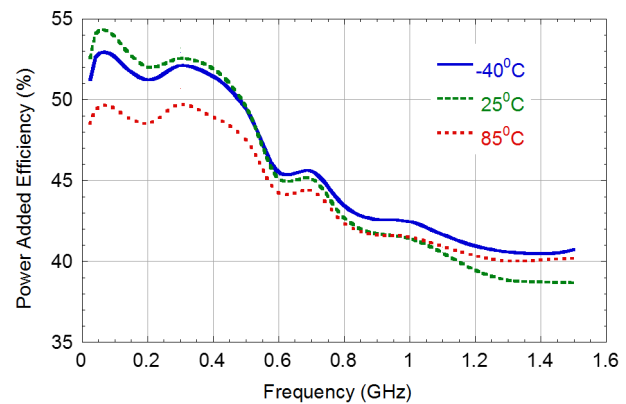


Figure 8: Power Added Efficiency vs. Frequency
($P_{OUT} = 37dBm$)

Typical Performance in 20 - 1500 MHz Broadband Circuit

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

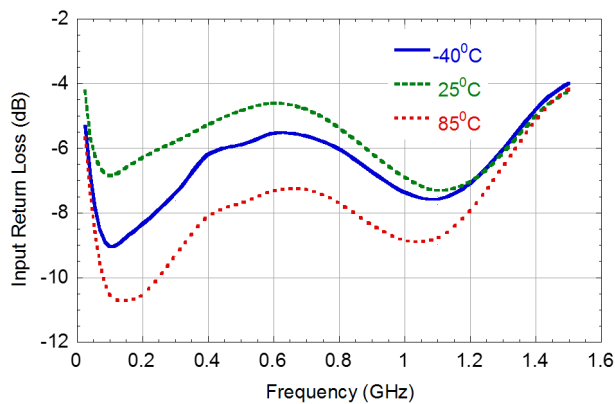


Figure 9: Input Return Loss vs. Frequency
($P_{OUT} = 37dBm$)

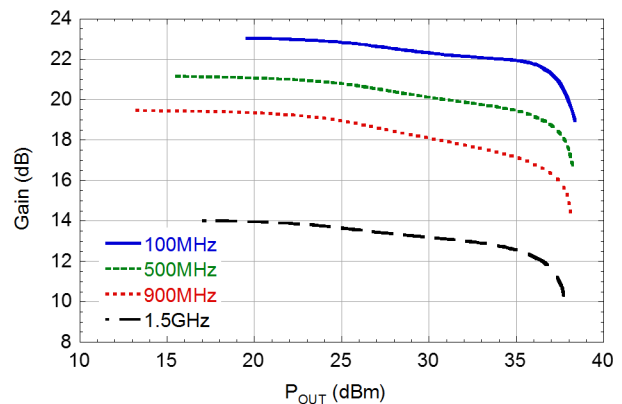


Figure 10: Gain vs. P_{OUT}

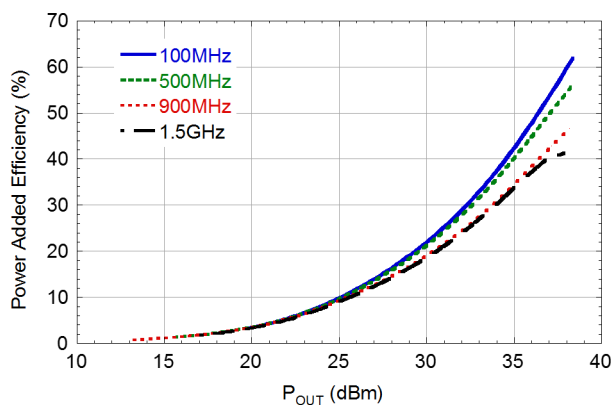


Figure 11: Power Added Efficiency vs. P_{OUT}

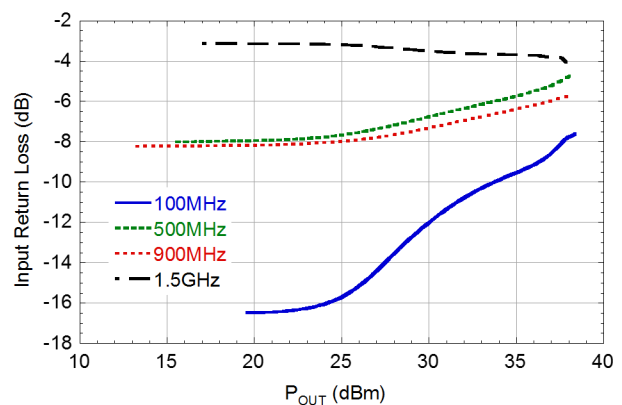


Figure 12: Input Return Loss vs. P_{OUT}

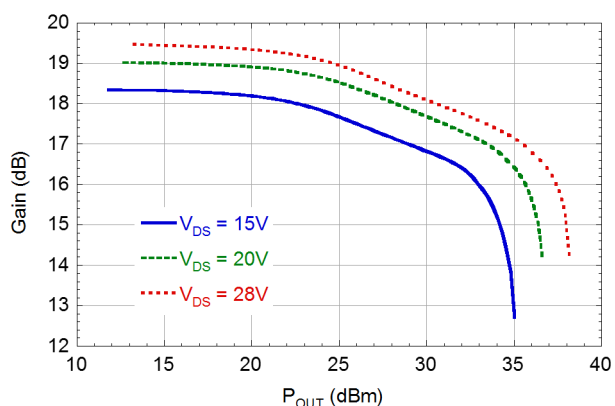


Figure 13: Gain vs. P_{OUT}
($f = 900MHz$)

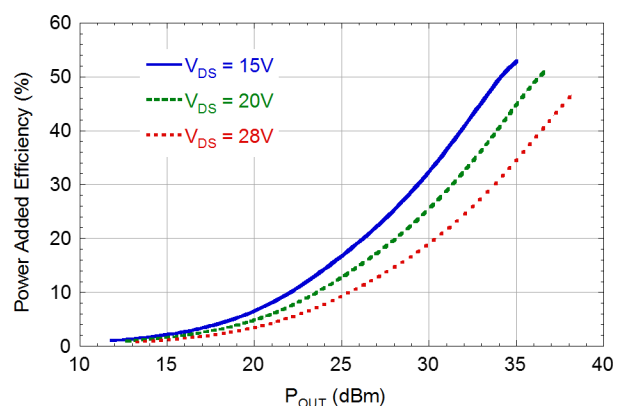


Figure 14: Power Added Efficiency vs. P_{OUT}
($f = 900MHz$)

Typical Performance in 20 - 1500 MHz Broadband Circuit

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

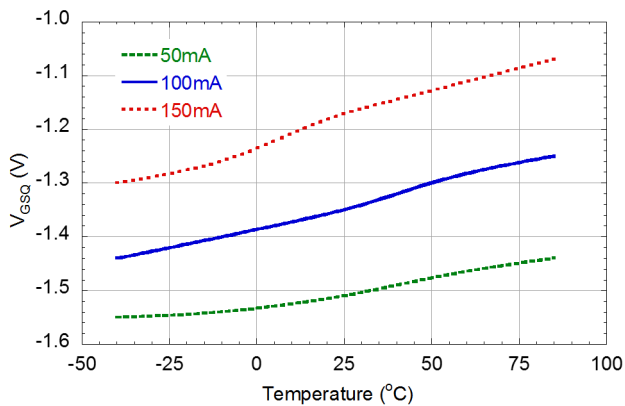


Figure 15: Quiescent V_{GS} vs. Temperature

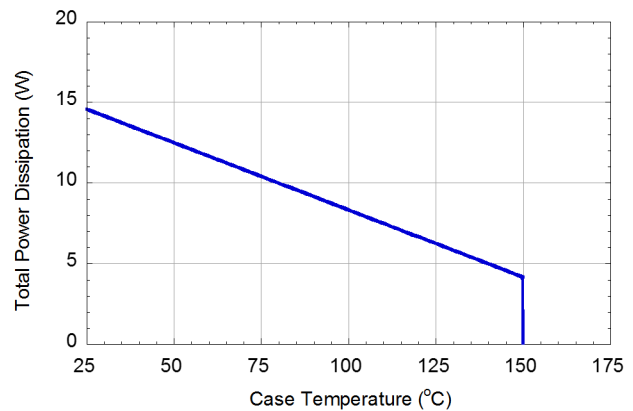


Figure 16: Power De-rating Curve
($T_J = 200^\circ C$, $T_C > 25^\circ C$)

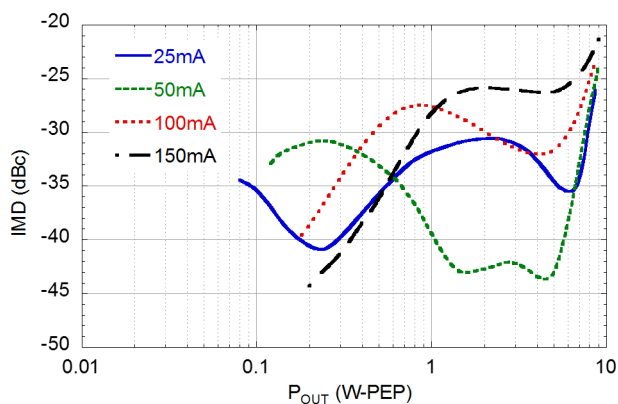


Figure 17: 2-Tone IMD3 vs. P_{OUT} vs. I_{DQ}
(1MHz Tone Spacing, $f = 500MHz$)

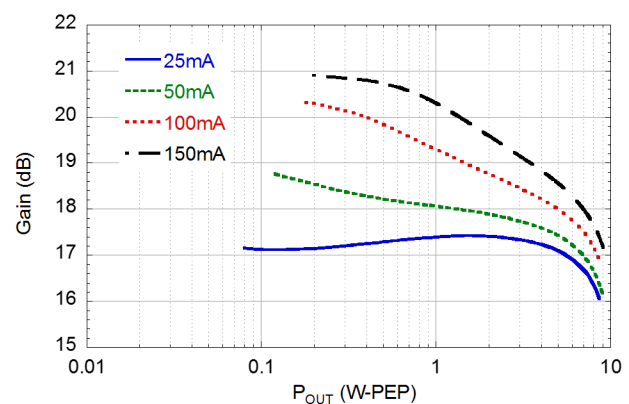


Figure 18: 2-Tone Gain vs. P_{OUT} vs. I_{DQ}
(1MHz Tone Spacing, $f = 500MHz$)

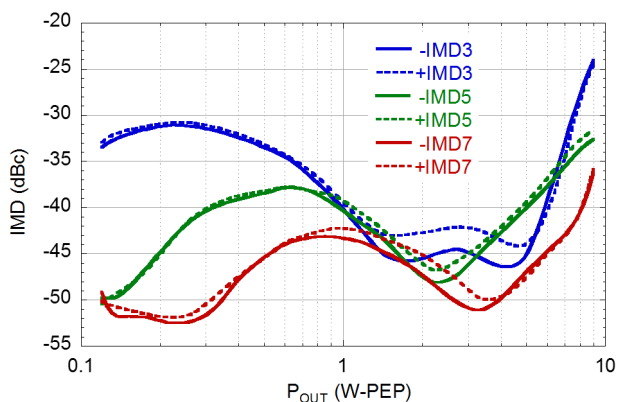


Figure 19: 2-Tone IMD vs. P_{OUT}
(1MHz Tone Spacing, $I_{DQ} = 50mA$, $f = 500MHz$)

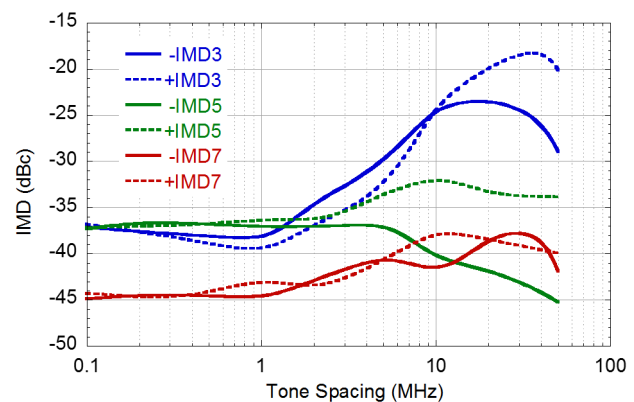


Figure 20: 2-Tone IMD vs. Tone Spacing
($P_{OUT} = 6W-PEP$, $I_{DQ} = 50mA$, $f = 500MHz$)

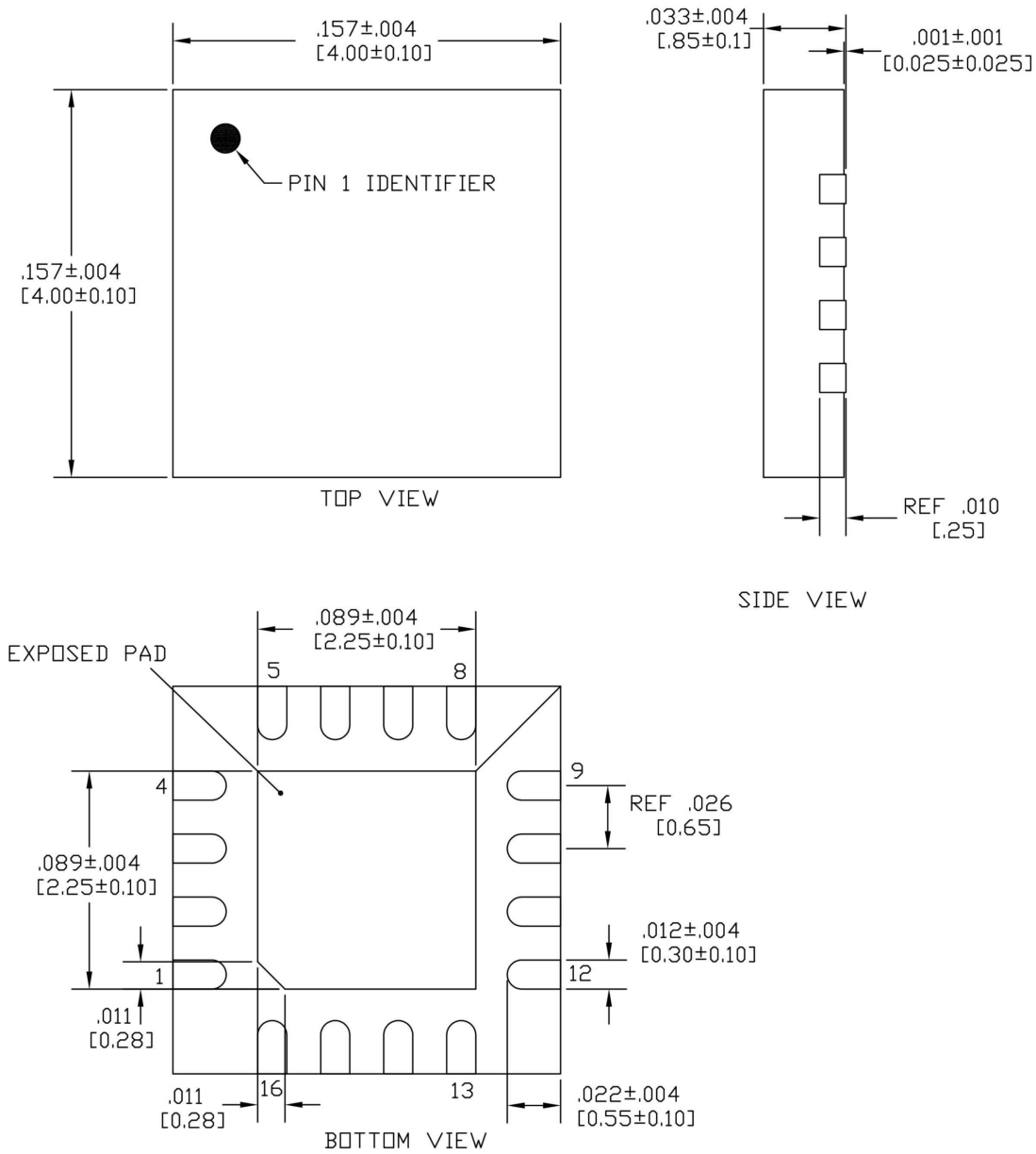


Figure 21 - QFN4X4-16 Plastic Package Dimensions (all dimensions in inches [millimeters])

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

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).**

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