

## Gallium Nitride 28V, 18W RF Power Transistor

Built using the SIGANTIC® NRF1 process - A proprietary GaN-on-Silicon technology

### FEATURES

- Optimized for CW, Pulsed, WiMAX, and other applications from 3300 - 3800 MHz
- 18W P3dB CW Power
- 25W P3dB peak envelope power
- 1.7W linear power @ 2% EVM for single carrier OFDM, 10.3dB peak/average, 10.3dB @ 0.01% probability on CCDF, 10.5dB gain, 18% drain efficiency
- Characterized for operation up to 32V
- 100% RF tested
- Thermally enhanced industry standard package
- High reliability gold metallization process
- Lead-free and RoHS compliant
- Subject to EAR99 export control



**3300 – 3800 MHz**  
**18 Watt, 28 Volt**  
**GaN HEMT**



**Typical 2-Tone Performance:**  $V_{DS} = 28V$ ,  $I_{DQ} = 200mA$ , Frequency = 3500MHz, Tone spacing = 1MHz,  $T_C = 25^\circ C$ .  
Measured in Nitronex Test Fixture

Symbol	Parameter	Min	Typ	Max	Units
$P_{3dB,PEP}$	Peak Envelope Power at 3dB Compression	14	18	-	W
$P_{1dB,PEP}$	Peak Envelope Power at 1dB Compression	-	10	-	W
$G_{SS}$	Small Signal Gain	10	11	-	dB
$\eta$	Peak Drain Efficiency at $P_{OUT} = P_{3dB}$	43	48	-	%

**RF Specifications (CW):**  $V_{DS} = 28V$ ,  $I_{DQ} = 200mA$ , Frequency = 3500MHz,  $T_C = 25^\circ C$ , Measured in Load Pull System

Symbol	Parameter	Typ	Units
$P_{3dB}$	Average Output Power at 3dB Gain Compression	18	W
$P_{3dB,Pulsed}$	Pulsed Output Power at 3dB Gain Compression	20	W
$P_{1dB,Pulsed}$	Pulsed Output Power at 1dB Gain Compression	15	W

**Typical OFDM Performance:**  $V_{DS} = 28V$ ,  $I_{DQ} = 200mA$ ,  $P_{OUT,AVG} = 1.7W$ , single carrier OFDM waveform 64-QAM 3/4, 8 burst, 20ms frame, 15ms frame data, 3.5MHz channel bandwidth. Peak/Avg = 10.3dB @ 0.01% probability on CCDF. Frequency = 3300 to 3800MHz.  $T_C = 25^\circ C$ . Measured in Load Pull System (Refer to Table 1 and Figure 1)

Symbol	Parameter	Typ	Units
$G_P$	Power Gain	10.5	dB
$\eta$	Drain Efficiency	18	%
EVM	Error Vector Magnitude	2.0	%
IRL	Input Return Loss	10	dB

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

Symbol	Parameter	Min	Typ	Max	Units
<b>Off Characteristics</b>					
$V_{BDS}$	Drain-Source Breakdown Voltage ( $V_{GS} = -8\text{V}$ , $I_D = 8\text{mA}$ )	100	-	-	V
$I_{DLK}$	Drain-Source Leakage Current ( $V_{GS} = -8\text{V}$ , $V_{DS} = 60\text{V}$ )	-	-	4	mA
<b>On Characteristics</b>					
$V_T$	Gate Threshold Voltage ( $V_{DS} = 28\text{V}$ , $I_D = 8\text{mA}$ )	-2.3	-1.8	-1.3	V
$V_{GSQ}$	Gate Quiescent Voltage ( $V_{DS} = 28\text{V}$ , $I_D = 200\text{mA}$ )	-2.0	-1.5	-1.0	V
$R_{ON}$	On Resistance ( $V_{GS} = 2\text{V}$ , $I_D = 60\text{mA}$ )	-	0.45	0.50	$\Omega$
$I_D$	Drain Current ( $V_{DS} = 7\text{V}$ pulsed, $300\mu\text{s}$ pulse width, 0.2% duty cycle, $V_{GS} = 2\text{V}$ )	-	5.0	-	A

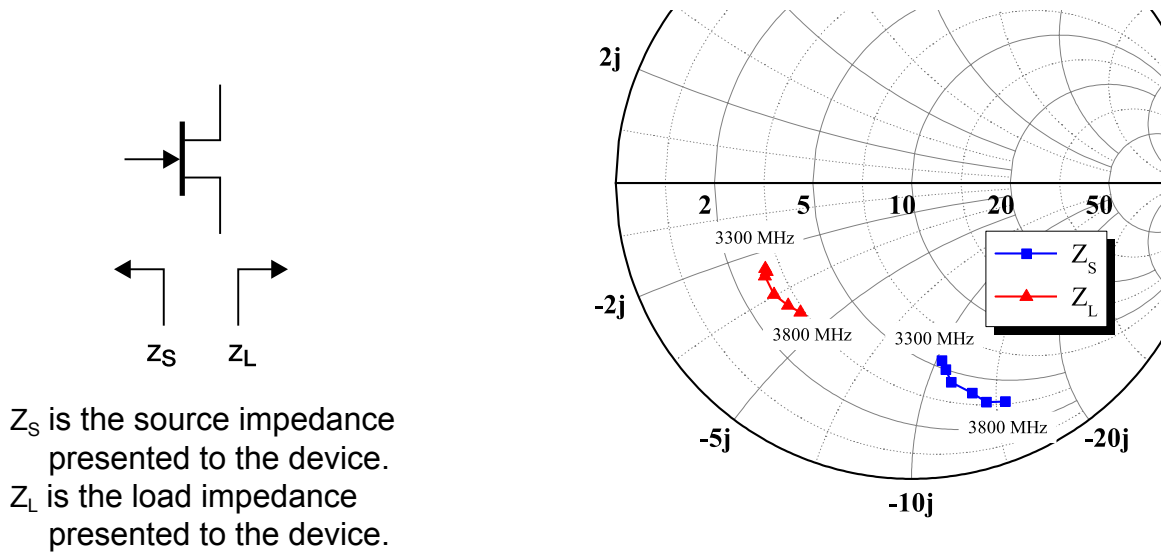
## Absolute Maximum Ratings: Not simultaneous, $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Max	Units
$V_{DS}$	Drain-Source Voltage	100	V
$V_{GS}$	Gate-Source Voltage	-10 to 3	V
$P_T$	Total Device Power Dissipation (Derated above $25^\circ\text{C}$ )	28	W
$\theta_{JC}$	Thermal Resistance (Junction-to-Case)	6.25	$^\circ\text{C}/\text{W}$
$T_{STG}$	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)	1A (>250V)	
MM	Machine Model ESD Rating (per JESD22-A115)	M1 (>50V)	

**Table 1:** Optimum Source and Load Impedances for OFDM Linearity,  $V_{DS} = 28V$ ,  $I_{DQ} = 200mA$

Frequency (MHz)	$Z_S (\Omega)$	$Z_L (\Omega)$	$P_{OUT} (W)$	Gain (dB)	Drain Efficiency (%)
3300 <sup>1</sup>	5.4 - j10.3	2.9 - j2.5	1.7	10.9	19
3400 <sup>1</sup>	5.0 - j10.7	2.9 - j2.6	1.8	11.0	22
3500 <sup>1</sup>	4.4 - j11.2	2.8 - j2.7	1.7	10.9	21
3600 <sup>1</sup>	4.0 - j12.5	2.8 - j3.3	1.7	10.9	20
3700 <sup>1</sup>	3.5 - j13.4	3.0 - j3.8	1.8	10.8	20
3800 <sup>1</sup>	3.5 - j14.6	3.2 - j4.2	1.8	10.7	20

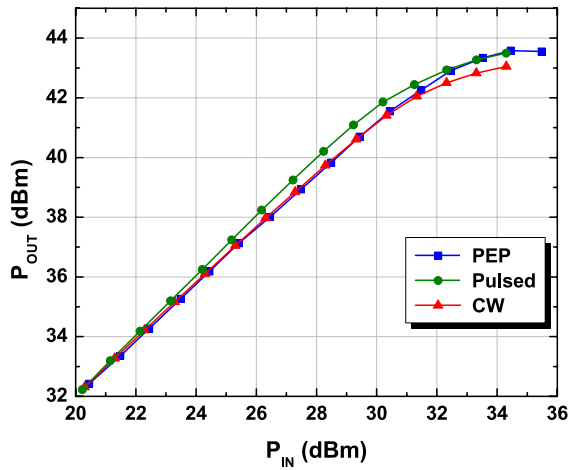
Note 1: Single carrier OFDM waveform 64-QAM 3/4, 8 burst, 20ms frame, 15ms frame data, 3.5 MHz channel bandwidth.  
Peak/Avg = 10.3dB @ 0.01% probability on CCDF, 2% EVM.



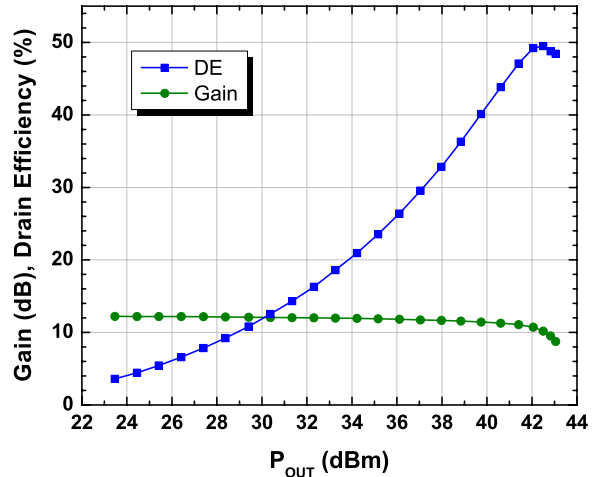
**Figure 1 -** Optimal Impedances for OFDM Linearity,  $V_{DS} = 28V$ ,  $I_{DQ} = 200mA$

## Load-Pull Data, Reference Plane at Device Leads

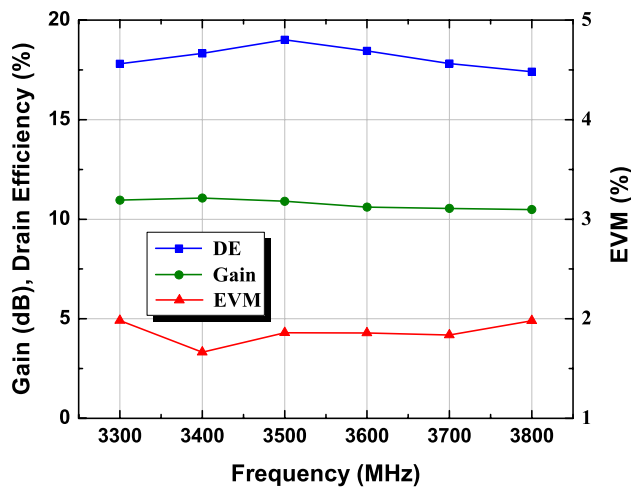
$V_{DS}=28V$ ,  $I_{DQ}=200mA$ ,  $T_A=25^\circ C$  unless otherwise noted.



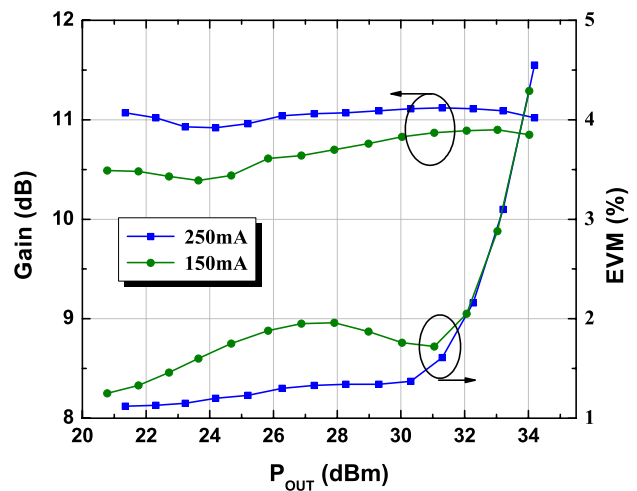
**Figure 2** - CW, pulsed CW, and PEP, 3500MHz, Constant Impedance States



**Figure 3** - CW Power Sweep, 3500MHz



**Figure 4** - Typical OFDM Performance  $P_{OUT} = 1.5W$



**Figure 5** - Typical OFDM Performance at 3500MHz versus  $I_{DQ}$

## Load-Pull Data, Reference Plane at Device Leads

$V_{DS}=28V$ ,  $I_{DQ}=200mA$ ,  $T_A=25^\circ C$  unless otherwise noted.

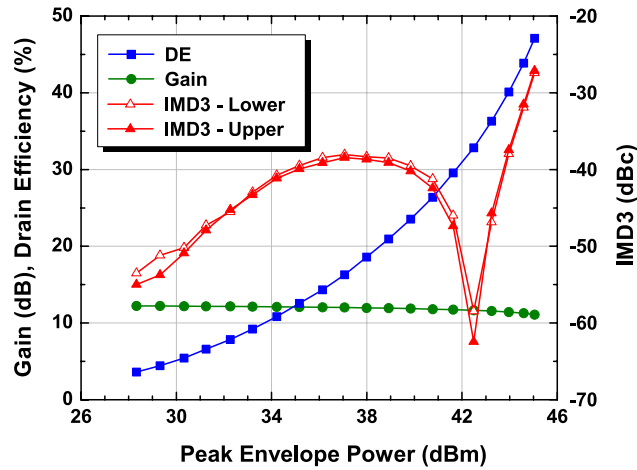


Figure 6 - Typical IMD3 Performance, 3500MHz

## Typical Device Characteristics

$V_{DS}=28V$ ,  $I_{DQ}=200mA$ ,  $T_A=25^\circ C$  unless otherwise noted.

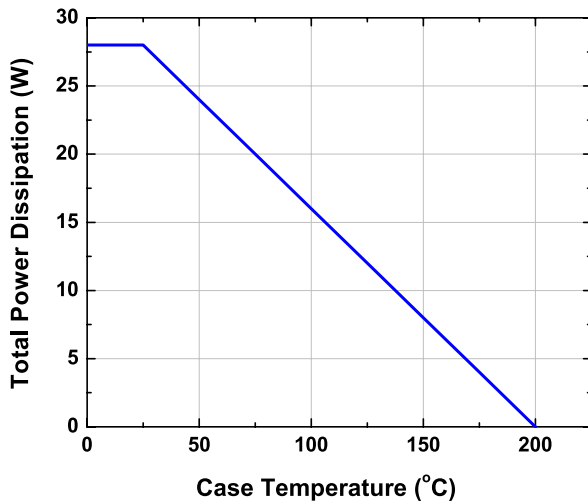


Figure 7 - Power Derating Curve

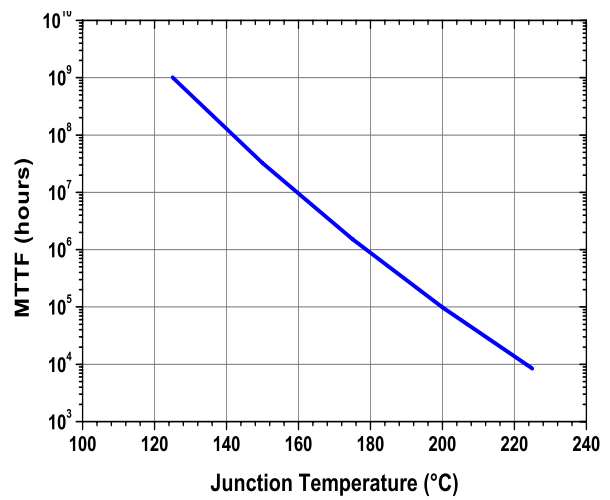
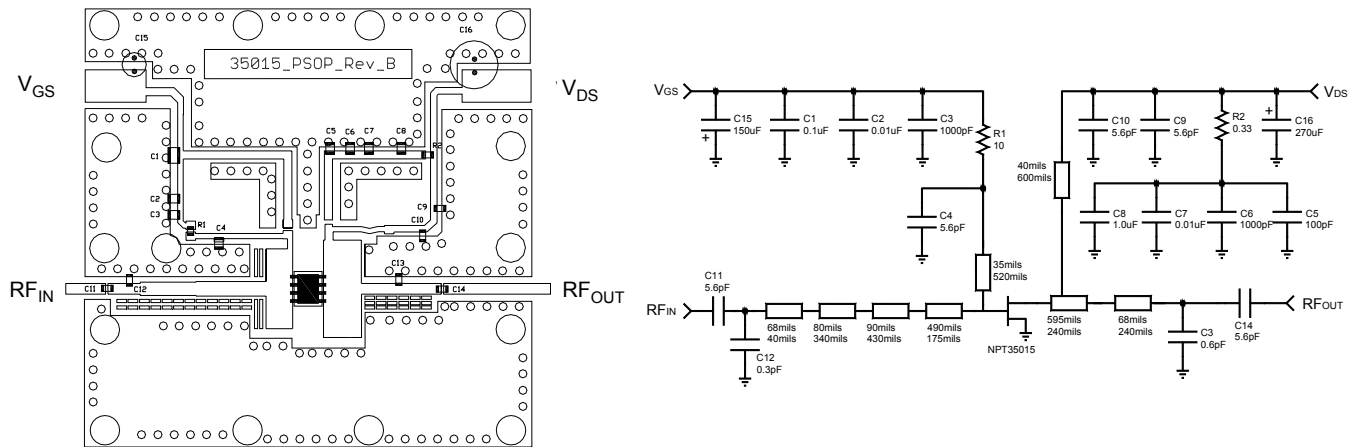


Figure 8 - MTTF of NRF1 Devices

## AD-006 3400-3600MHz 1.7W Linear WiMAX Application Design

802.16e Single Carrier OFDM, 64-QAM 3/4, 8-burst, 20ms frame 100% filled, 3.5MHz channel bandwidth, PAR=10.3dB @ 0.01% CCDF  
 Detailed design information and data available at [www.nitronex.com](http://www.nitronex.com)



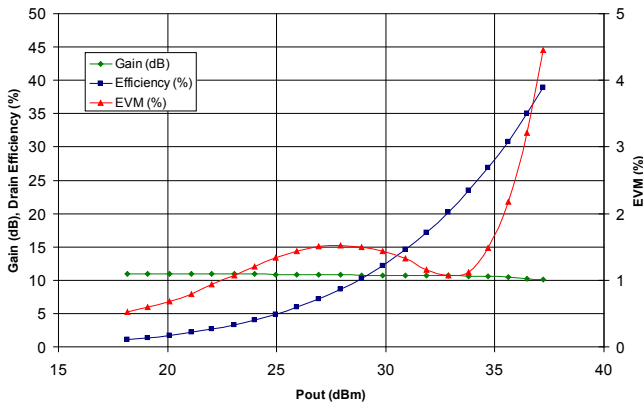
**Figure 9 - AD-006 Demonstration Board and Schematic**

**Table 2: AD-006 Demonstration Board Bill of Materials**

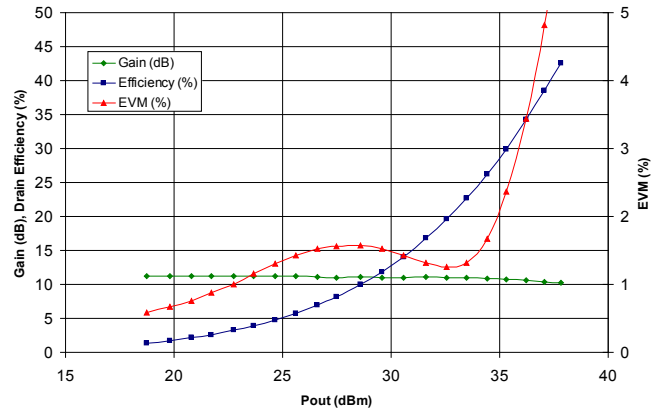
Name	Value	Tolerance	Vendor	Vendor Number
C1	0.1uF	10%	Kemet	C1206C104K1RACTU
C2, C7	0.01uF	10%	AVX	12061C103KAT2A
C3, C6	1000pF	10%	Kemet	C0805C102K1RACTU
C5	100pF	10%	Kemet	C0805C101K1RACTU
C8	1.0uF	10%	Panasonic	ECJ-5YB2A105M
C4, C9, C10, C11, C14	5.6pF	+/- 0.1pF	ATC	ATC600F5R6B
C12	0.3pF	+/- 0.1pF	ATC	ATC600F0R3B
C13	0.6pF	+/- 0.1pF	ATC	ATC600F0R6B
C15	150uF	20%	Nichicon	UPW1C151MED
C16	270uF	20%	United Chemi-Con	ELXY630ELL271MK25S
R1	10 ohm	1%	Panasonic	ERJ-2RKF10R0X
R2	0.33 ohm	1%	Panasonic	ERJ-6RQFR33V
PA1	--	--	--	NPT35015D
Substrate			Rogers	R04350, t = 30mil $\epsilon_r = 3.5$

## AD-006 3400-3600MHz 1.7W Linear WiMAX Application Design

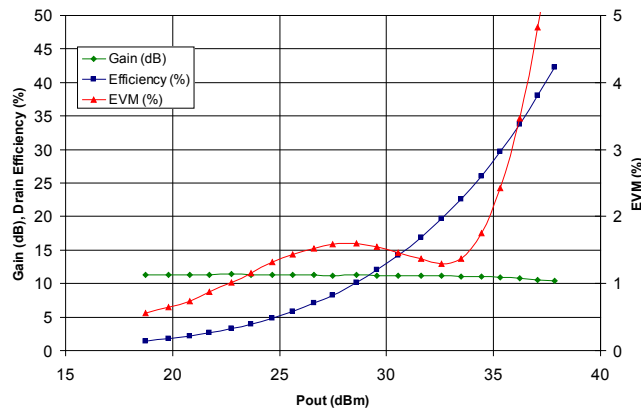
802.16e Single Carrier OFDM, 64-QAM 3/4, 8-burst, 20ms frame 100% filled, 3.5MHz channel bandwidth, PAR=10.3dB @ 0.01% CCDF  
 Detailed design information and data available at [www.nitronex.com](http://www.nitronex.com)



**Figure 10 - Gain, Efficiency, EVM at 3400MHz**



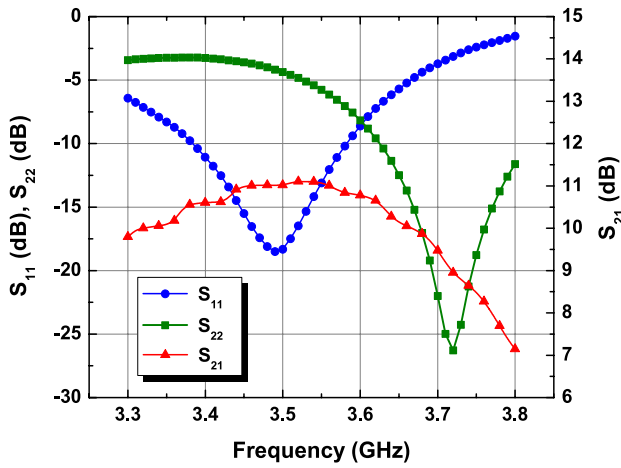
**Figure 11 - Gain, Efficiency, EVM at 3500MHz**



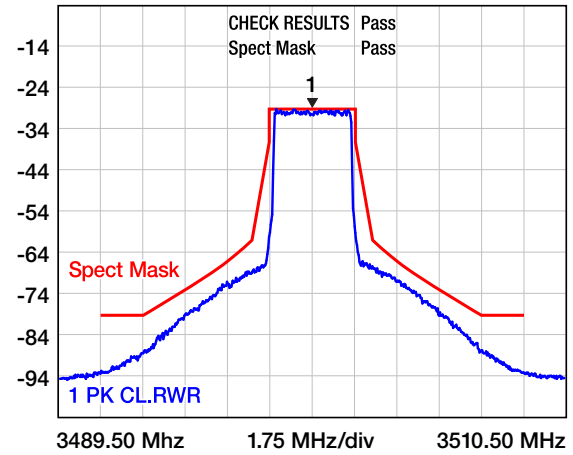
**Figure 12 - Gain, Efficiency, EVM at 3600MHz**

## AD-006 3400-3600MHz 1.7W Linear WiMAX Application Design

802.16e Single Carrier OFDM, 64-QAM 3/4, 8-burst, 20ms frame 100% filled, 3.5MHz channel bandwidth, PAR=10.3dB @ 0.01% CCDF  
 Detailed design information and data available at [www.nitronex.com](http://www.nitronex.com)



**Figure 14** - Typical  $S_{11}$  and  $S_{21}$



**Figure 13** - ETSI Mask Compliance in Nitronex Demonstration Board at 3500MHz and  $P_{OUT} = 1.5W$



# NPT35015

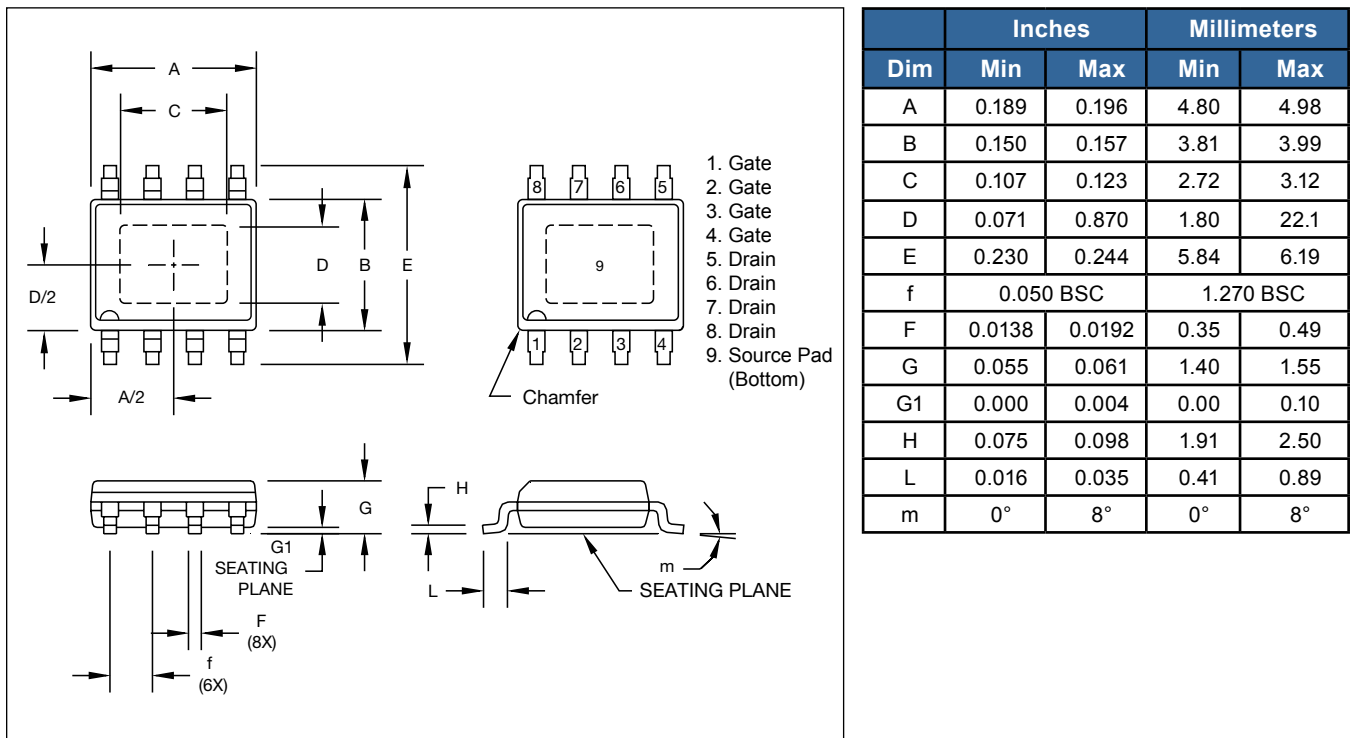


## Ordering Information

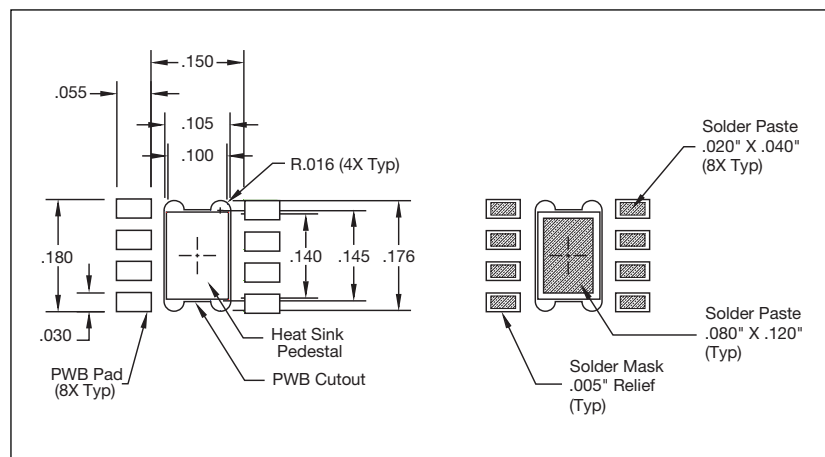
Part Number	Order Multiple	Description
NPT35015DT	97	Tube; NPT35015 in D (PSOP2) Package
NPT35015DR	1500	Tape and Reel; NPT35015 in D (PSOP2) Package

1: To find a Nitronex contact in your area, visit our website at <http://www.nitronex.com>

**Figure 15 - D Package Dimensions and Pinout**



**Figure 16 - Mounting Footprint**



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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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