

## Gallium Nitride 28V, 50W RF Power Transistor

Built using the SIGANTIC<sup>®</sup> NRF1 process - A proprietary GaN-on-Silicon technology

### FEATURES

- Optimized for CW, pulsed, WiMAX, and other applications from 3300 – 3800 MHz
- 90W P<sub>3dB</sub> PEP power
- 65W P<sub>3dB</sub> CW power
- 6W linear power @ 2.0% EVM for single carrier OFDM, 10.3dB peak/avg, 3.5MHz channel bandwidth, 12dB gain, 18% efficiency
- Qualified 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**  
**50 Watt, 28 Volt**  
**GaN HEMT**



**RF Specifications (CW):** V<sub>DS</sub> = 28V, I<sub>DQ</sub> = 750mA, Frequency = 3500MHz, T<sub>C</sub> = 25°C, Measured in Nitronex Test Fixture

Symbol	Parameter	Min	Typ	Max	Units
P <sub>3dB</sub>	Average Output Power at 3dB Compression	-	65	-	W
P <sub>3dB,pulsed</sub>	Pulsed Output Power at 3dB Compression (100µs pulse width, 1% duty cycle)	-	85	-	W
G <sub>SS</sub>	Small Signal Gain	11	12.5	13.5	dB
η	Peak Drain Efficiency at P <sub>OUT</sub> =P <sub>3dB</sub>	40	45	-	%

**Typical 2-Tone Performance:** V<sub>DS</sub> = 28V, I<sub>DQ</sub> = 750mA, Frequency = 3500MHz, Tone Spacing = 0.1MHz, T<sub>C</sub> = 25°C  
 Measured in Load-Pull System

Symbol	Parameter	Typ	Units
P <sub>3dB,PEP</sub>	Peak Envelope Power at 3dB Compression	95	W
P <sub>1dB,PEP</sub>	Peak Envelope Power at 1dB Compression	55	W
P <sub>IM3</sub>	Peak Envelope Power at -35dBm IM3	66	W

**Typical OFDM Performance:** V<sub>DS</sub> = 28V, I<sub>DQ</sub> = 750mA, 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. Frequency = 3400 - 3600MHz. P<sub>OUT,AVG</sub> = 38dBm, T<sub>C</sub> = 25°C. Measured in Load Pull System (Refer to Table 1 and Figure 1)

Symbol	Parameter	Typ	Units
G <sub>P</sub>	Power Gain	12	dB
η	Drain Efficiency	18	%
EVM	Error Vector Magnitude	2.0	%
IRL	Input Return Loss	9	dB

# NPT35050A Datasheet



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

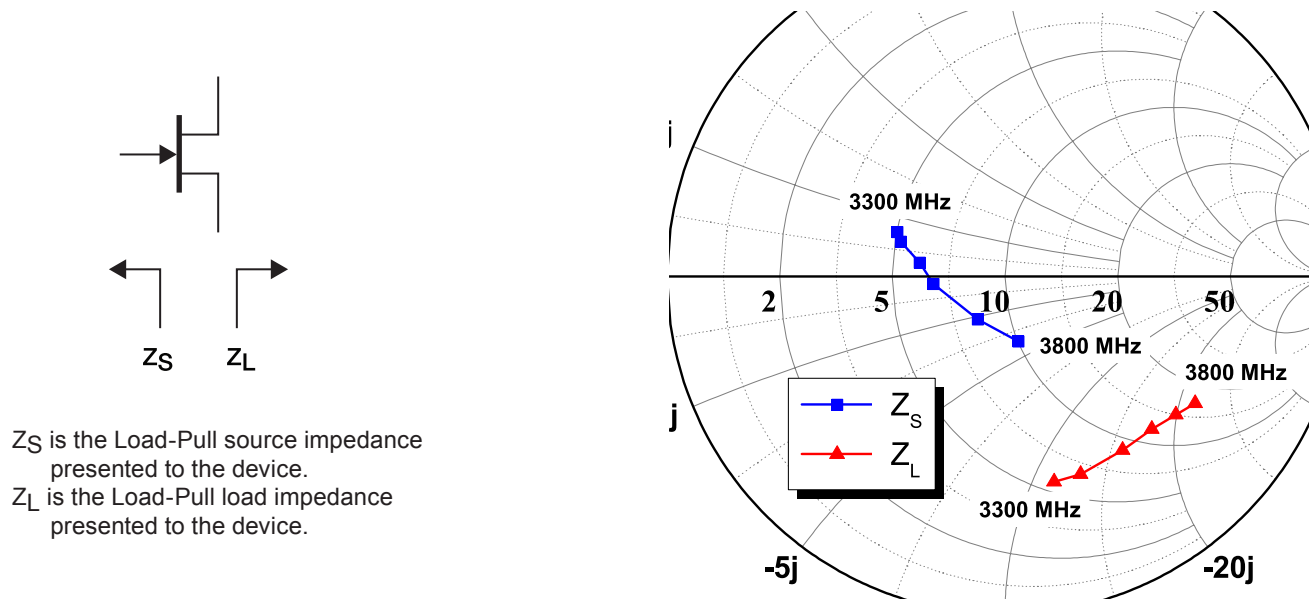
Symbol	Parameter	Min	Typ	Max	Units
<b>Off Characteristics</b>					
$V_{BDS}$	Drain-Source Breakdown Voltage ( $V_{GS}=-8\text{V}$ , $I_{DQ}=16\text{mA}$ )	100	-	-	V
$I_{DLK}$	Drain-Source Leakage Current ( $V_{GS}=-8\text{V}$ , $V_{DS}=60\text{V}$ )	-	2	5	mA
<b>On Characteristics</b>					
$V_T$	Gate Threshold Voltage ( $V_{DS} = 28\text{V}$ , $I_{DQ} = 16\text{mA}$ )	-2.3	-1.8	-1.3	V
$V_{GSQ}$	Gate Quiescent Voltage ( $V_{DS} = 28\text{V}$ , $I_{DQ} = 750\text{mA}$ )	-2.0	-1.5	-1.0	V
$R_{ON}$	On Resistance ( $V_{GS} = 2\text{V}$ , $I_{DQ} = 270\text{mA}$ )	-	0.13	0.15	W
$I_D$	Drain Current ( $V_{DS} = 7\text{V}$ pulsed, 300ms pulse width, 0.2% duty cycle, $V_{GS}=2\text{V}$ )	18.0	19.5	-	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 $25^\circ\text{C}$ )	90	W
$\theta_{JC}$	Thermal Resistance (Junction-to-Case)	1.95	$^\circ\text{C}/\text{W}$
$T_{STG}$	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)	1C (>1000V)	
MM	Machine Model ESD Rating (per JESD22-A115)	M3 (>200V)	

**Table 1:** Optimum Impedance Characteristics for OFDM Tuning ( $V_{DD}=28V$ ,  $I_{DQ}=750\text{ mA}$ ).

Frequency	$Z_S (\Omega)$	$Z_L (\Omega)$
3300	$5.0 + j1.5$	$5.5 - j11.0$
3400	$5.2 + j1.2$	$6.4 - j12.3$
3500	$6.0 + j0.5$	$8.9 - j14.9$
3600	$6.4 - j0.2$	$9.5 - j17.2$
3700	$7.0 - j2.5$	$10.1 - j20.1$
3800	$10.0 - j4.0$	$16.3 - j22.6$



**Figure 1 - Optimal Impedances for OFDM Performance** -  $V_{DS} = 28V$ ,  $I_{DQ} = 750mA$

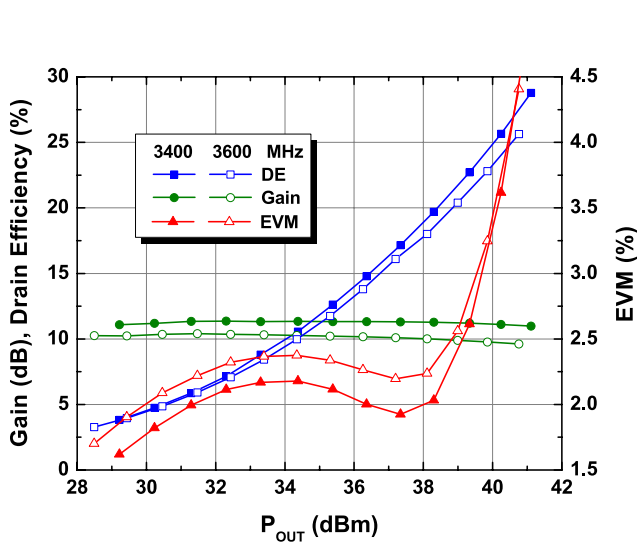


Figure 2 - Typical OFDM Performance in Nitronex Demonstration Board

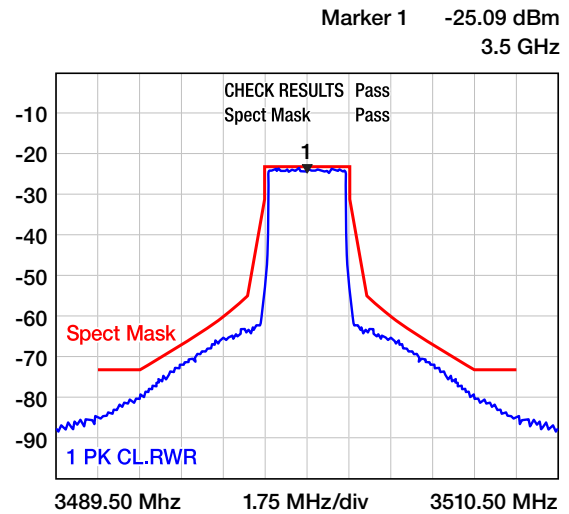


Figure 3 - ETSI Mask Compliance in Nitronex Demonstration Board, 3500MHz and  $P_{OUT} = 38\text{dBm}$

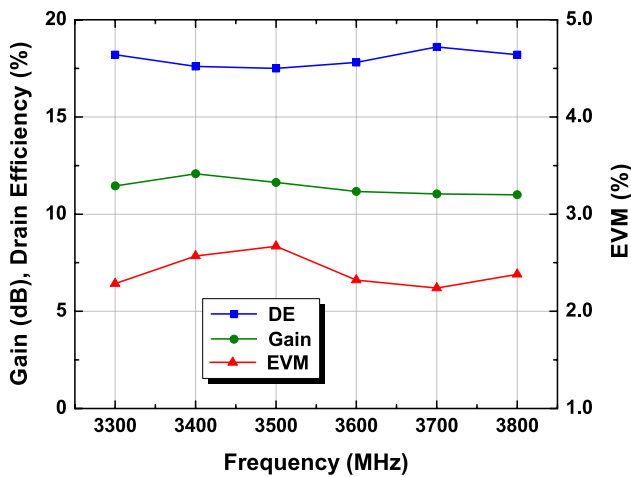


Figure 4 - Typical OFDM Performance in Load-Pull System,  $P_{OUT} = 38\text{dBm}$

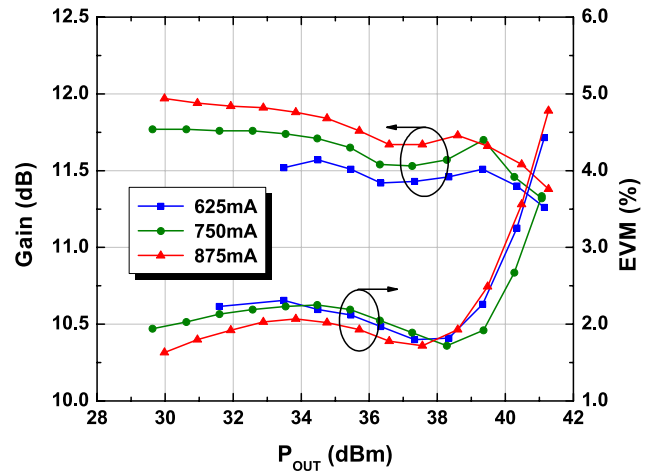
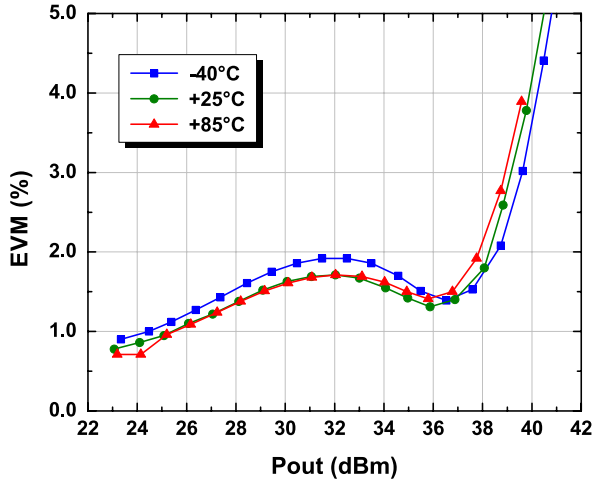
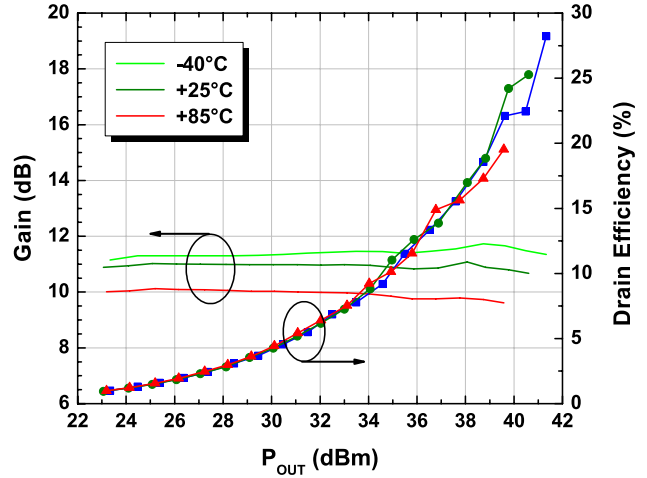


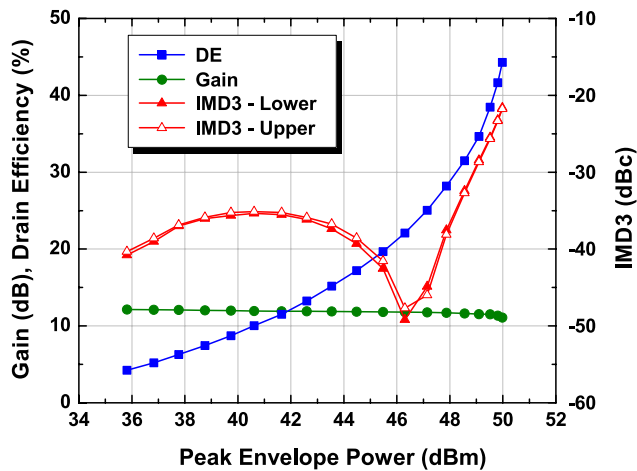
Figure 5 - Typical OFDM Performance at 3500MHz versus  $I_{DQ}$



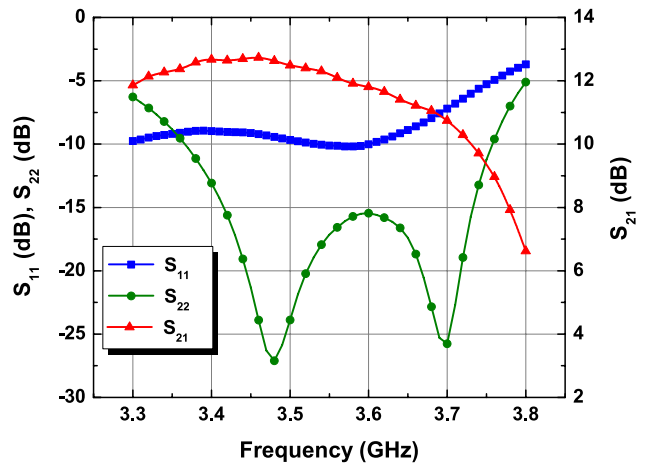
**Figure 6** - Typical Device Linearity over Temperature in Nitronex Demonstration Board, 3400MHz,  $V_{DS} = 28V$ ,  $I_{DQ} = 750mA$



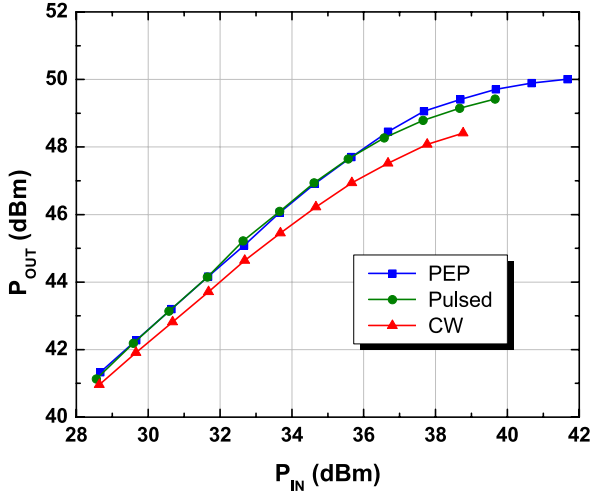
**Figure 7** - Typical Device Gain and Efficiency over Temperature in Nitronex Demonstration Board, 3400 MHz,  $V_{DS} = 28V$ ,  $I_{DQ} = 750mA$



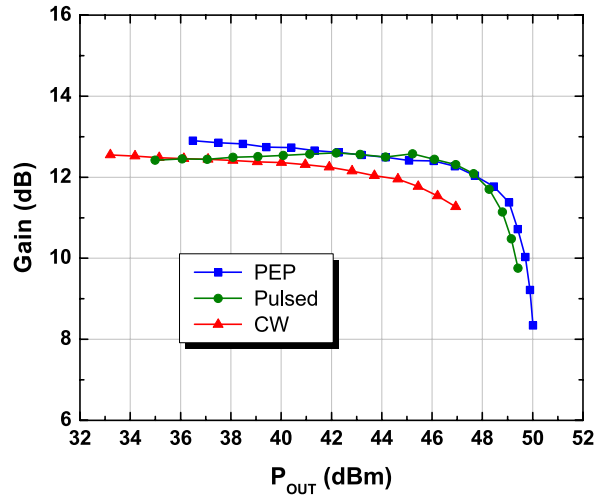
**Figure 8** - Typical IMD3 Performance at 3500 MHz,  $V_{DS} = 28V$ ,  $I_{DQ} = 750mA$



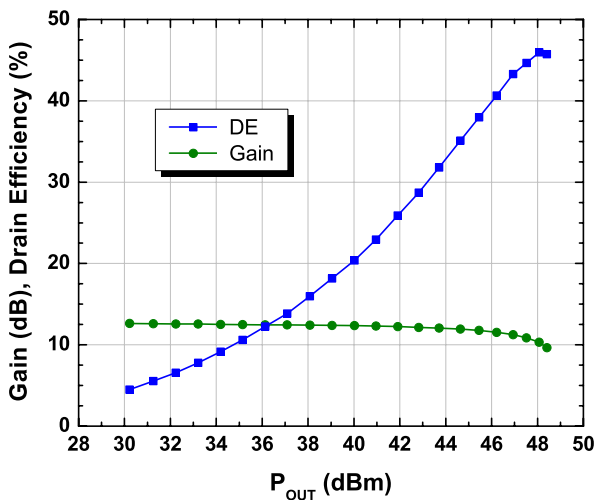
**Figure 9** - Typical  $S_{11}$  and  $S_{21}$  in Nitronex Demonstration Board,  $P_{IN} = 0$  dBm,  $V_{DS} = 28V$ ,  $I_{DQ} = 750mA$



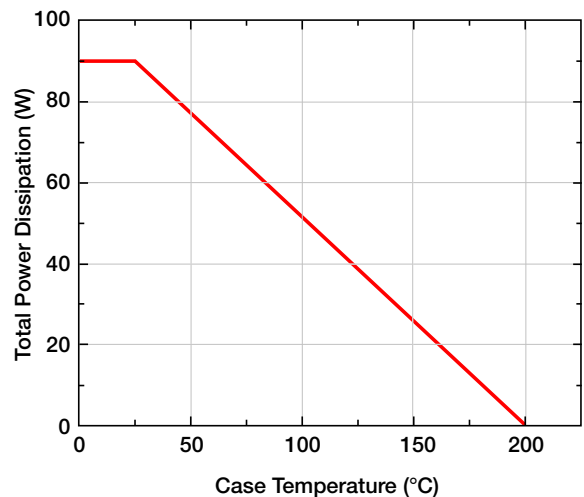
**Figure 10** - Power Sweeps for CW, pulsed CW, and PEP,  $V_{DS} = 28V$ ,  $I_{DQ} = 750mA$ , 3500MHz, Constant Impedance States for All Sweeps



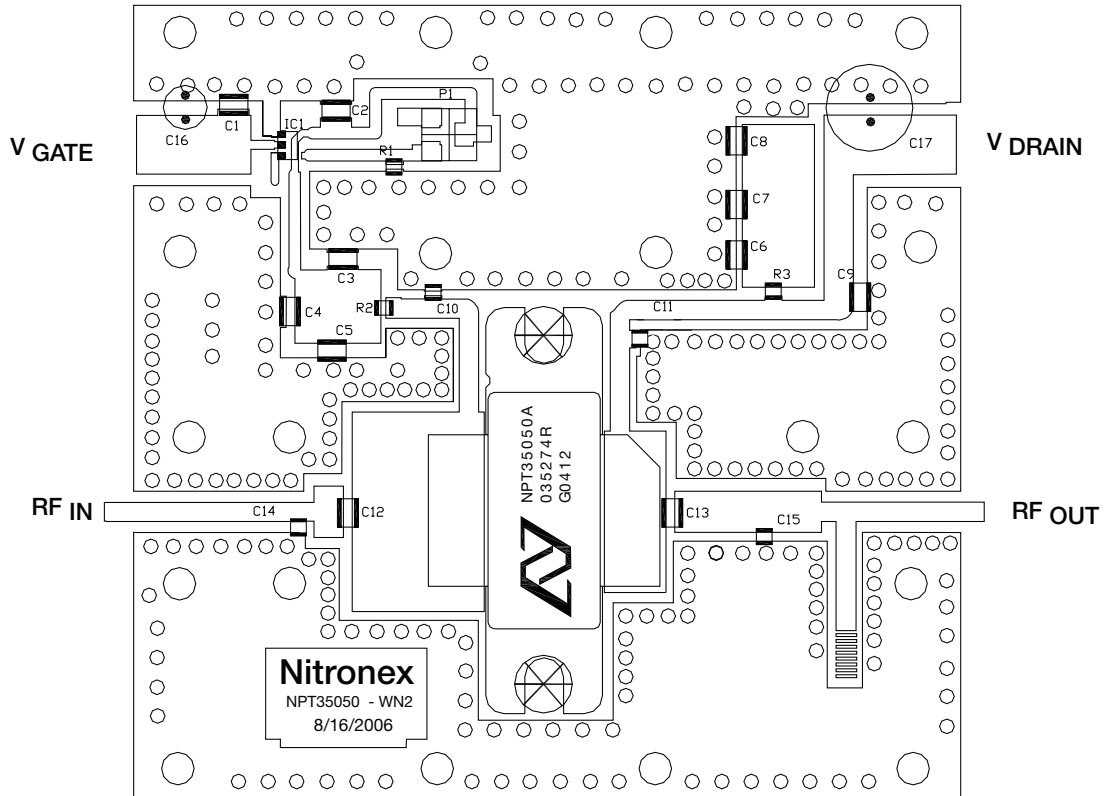
**Figure 11** - Power Sweeps for CW, pulsed CW, and PEP at  $V_{DS} = 28V$ ,  $I_{DQ} = 750mA$ , 3500 MHz, Constant Impedance States for All Sweeps



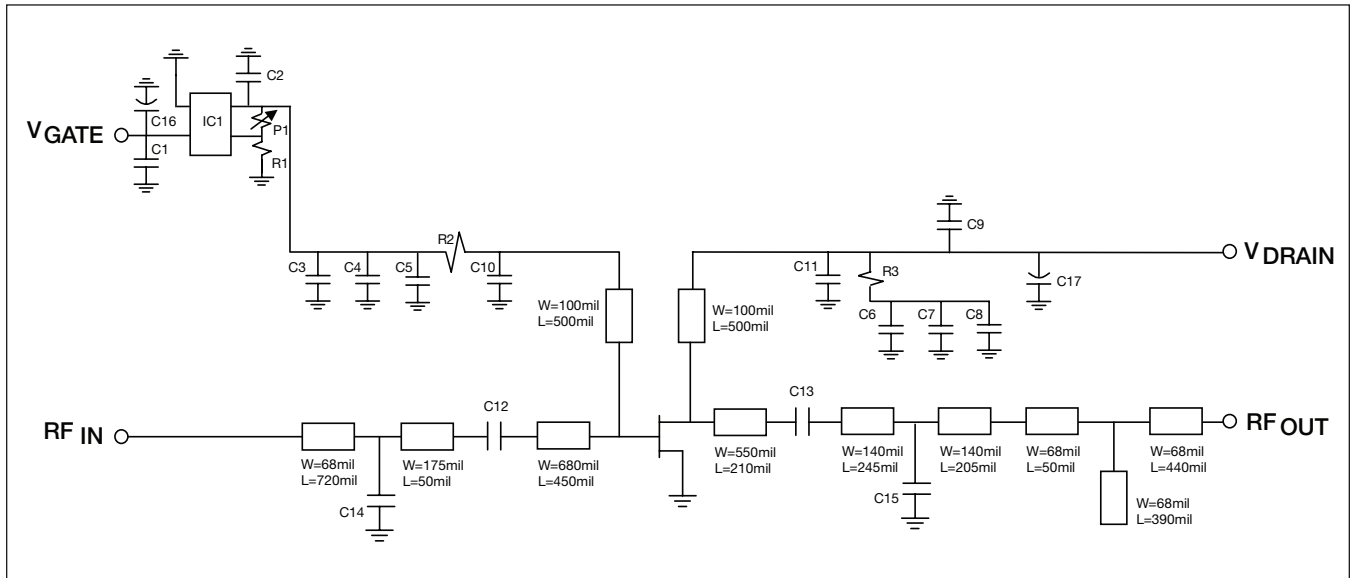
**Figure 12** - CW Power Sweep,  $V_{DS} = 28V$ ,  $I_{DQ} = 750mA$ , 3500 MHz



**Figure 13** - Power Derating Curve Based on  $P_{DISS} = 90W$ ,  $\theta_{JC} = 1.95^{\circ}C/W$



**Figure 14 - Nitronex NPT35050 Demonstration Board and Component Placement.**



**Figure 15** - Nitronex NPT35050 Demonstration Board Schematic

**Table 1:** Bill of Materials

Component	ID Value
C1, C2, C3	10uF 16V Ceramic X7R (1210)
C4, C7	0.01uF 100V Ceramic X7R (1206)
C5, C8	0.1uF 100V Ceramic X7R (1206)
C6, C9	1.0uF 100V Ceramic X7R (1812)
C10, C11, C12, C13	5.6pF ATC600F5R6CT
C14	1.0pF ATC600F1R0AT
C15	1.5pF ATC600F1R5AT
C16	16V, 150uF Aluminum Electrolytic - Nichicon
C17	63V, 270uF Aluminum Electrolytic - UCC (LXY)
R1	12k Ohm (0603)
R2	10 Ohm (0805)
R3	0.33 Ohm (0805)
P1	20k Ohm Potentiometer - Bourns (3224 series)
IC1	IC LT1964-BYP
Substrate	Taconic RF35 t=30mil, $\epsilon_r=3.5$ , 1 oz. Cu

# NPT35050A Datasheet



## Ordering Information<sup>1</sup>

Part Number	Description
NPT35050AB	NPT35050 in AC780-F2 Bolt-Down Package

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

## AC780BM-F2 Package Dimensions and Pinout (all dimensions are in inches)

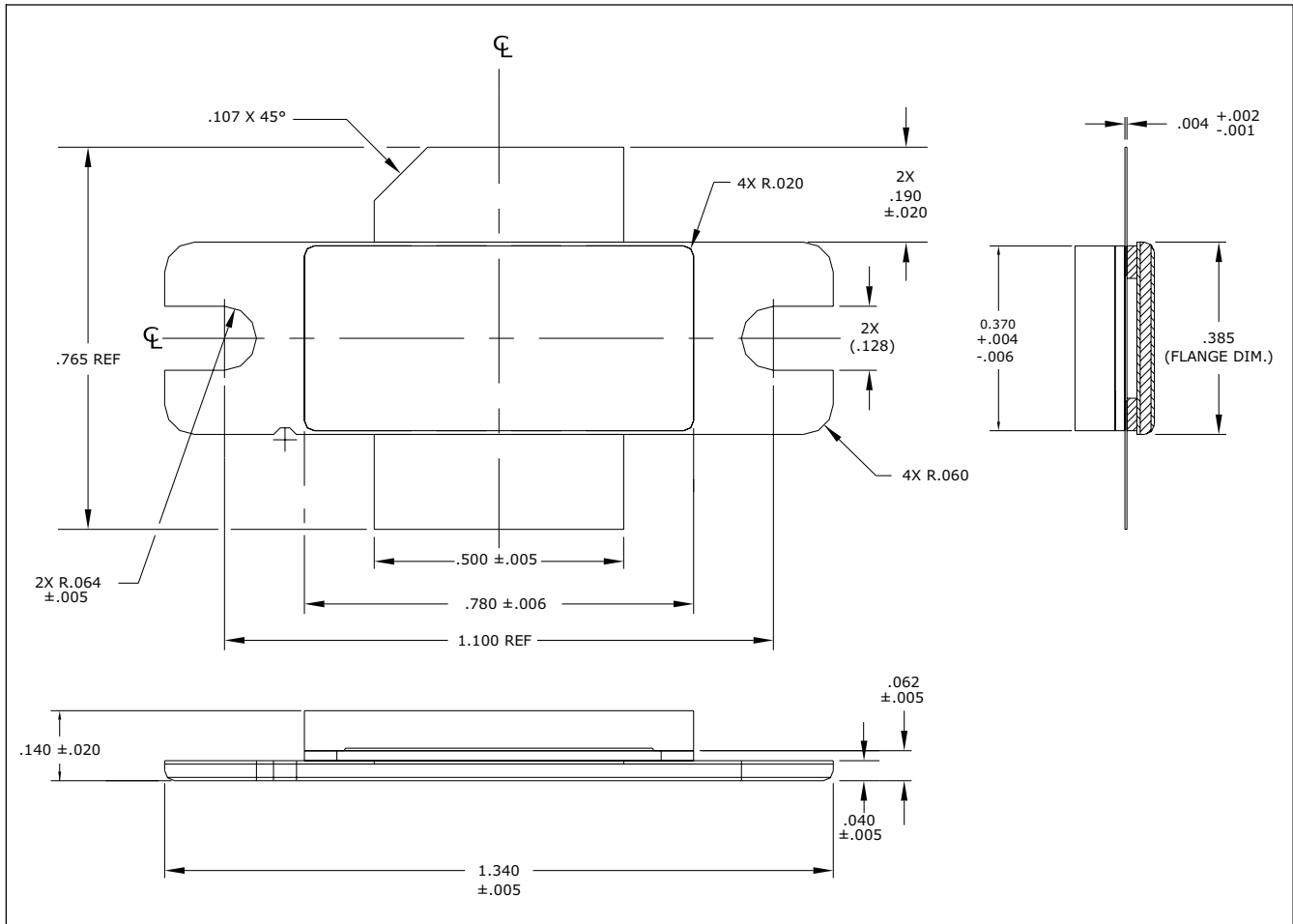
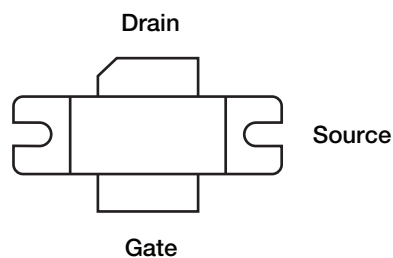


Figure 16 - Terminal Identification



# NPT35050A Datasheet



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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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